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SILK-CULTURE

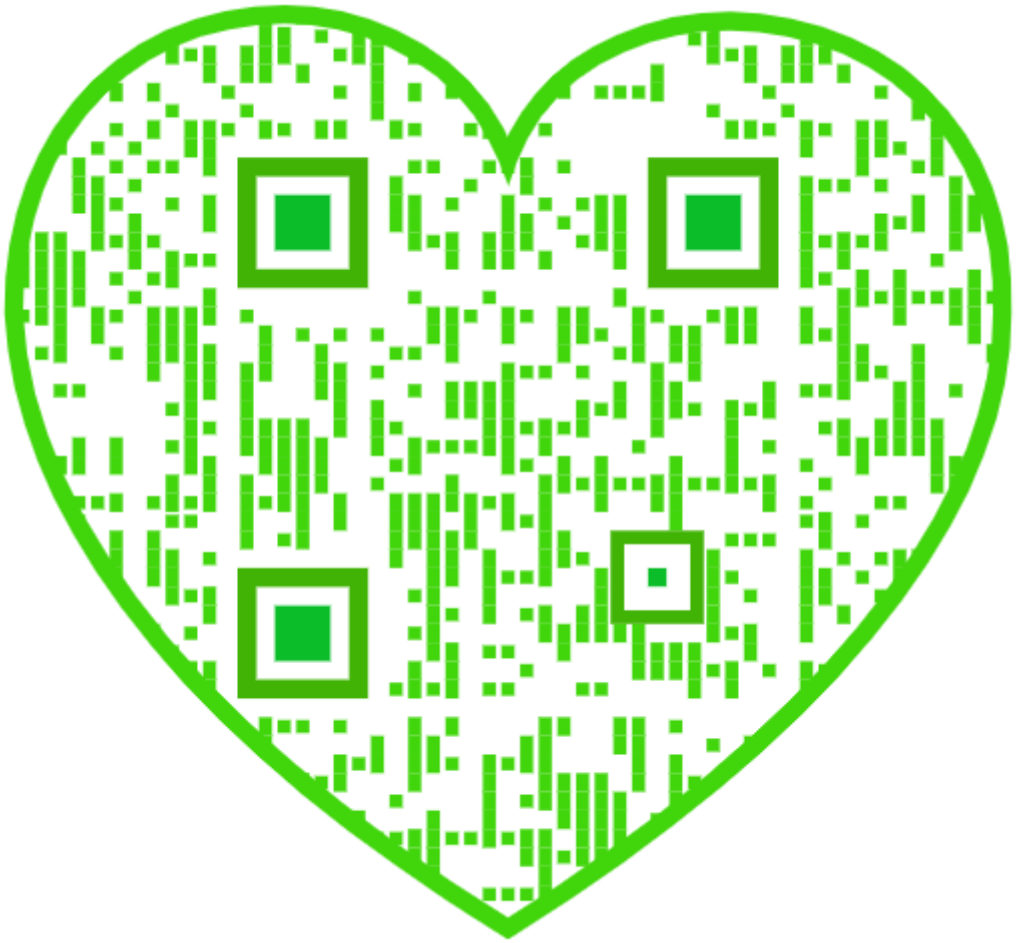
DIRECTORY.

BY

G. BARRICELLI.

(3d. Eng. Ed.)

1884.



SILK

CROP

MISSISSIPPI VALLEY SILK-CULTURE CO.

HOLDEN MISSOURI, P. O BOX 414.

SILK FROM OSAGE.

Prof. G BARRICELLI, Director.

NOTICE.

The third, PRACTICAL, *season of this* ENTERPRISE *being near at hand, we take pleasure to inform the would be* SILK-GROWERS, *that we propose to give,* FREE, *next spring, again, either young Silk-Caterpillars, or Caterpillars' eggs, directions, instructions, &c., as written in the* AGREEMENT *which will be sent to any address on application.*

PRICE of Silk-Caterpillar Eggs, SELECTED, Examined, and cared for.

ONE OUNCE FIVE DOLLARS: FRACTIONS of Oz. in Proportion.

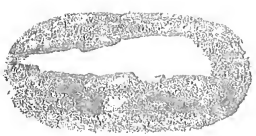
☞ Orders for eggs (from persons who do not already work in accord with this Company) taken now. Each order should be sent accompanied with one-fourth of price. When the hatching time arrives we give notice; and, on receipt of balance of money, forward the eggs.

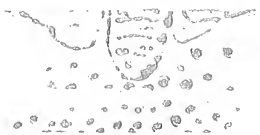
The Silk-Culture DIRECTORY, worth, $1., is given free to orders of 1 oz. of seed.

***Cocoons bought *(fresh only,* i. e. just after gathering) at market price, in ready cash!

WRITE US A P. C., HAND THIS NOTE TO YOUR ACQUAINTANCES, PLEASE!

G. BARRICELLI.





FOR,

1884.

SILK-CULTURE DIRECTORY

AND

SILK-CATERPILLARS DISORDERS.

BY

G. BARRICELLI.

(11th Edition, the 3d in English.)

Ex Cathedra.

2653 P1

1884.

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☞ *Thirty nine faithfull sketches* BESIDES THE FRONT SPECIES *illustrate the development of the subject.*

PREFACE TO THE ELEVENTH EDITION,

(the 1st in English.)

The greatest industry for housewives, girls, school girls, thrifty ladies women in general, semy-invalid people, boys out of school, smart children, teachers in vacation, people enjoying the country, clergymen, and other people–*having leisure time at home*, is the ART OF GROWING SILK.

The Silk-CATERPILLAR (*commonly, or after the French manner, called* WORMS—in *F.* "*ver a soie*", in *German* "*Seidenraupe*", in *Italian* "*bigatto*" etc.) that produce their highly priced textil material, so much sought after by dignitaries and by brides, IS SO CLEAN AND INDUSTRIOUS THAT IT RIVALS THE BEE, AND SO HARMLESS AND USEFUL THAT, IT PROVES TO BE SUPERIOR, BY FAR, TO THE HONEY PRODUCING CREATURE; and of such intrinsic value that each 10,000 of them (occupying no more than fifteen square yards of surface) yield more dollars and cents, in 40 days, than ten hens in the lapse of a year, for:

Ten thousand Silk-Caterpillars, of selected breed and in favourable season, will produce, in about forty days, silk valued at, about, *twelve* dollars, whilst ten hens can scarcely produce 200 eggs, in such lenght of time, hardly valued two dollars and no more!

We quote the hens because, usually, they are the means employed to raise *pin money*; but it is not difficult to prove that even a cow produces, in forty days less than a 'brood' of Silk-Caterpillars. In fact *if* a cow yields, in same time, 120 gallons of milk it brings into

the house less than six dollars, (not either calculating the outlay invested for her keeping) when if, say, 20,000 of Caterpillars are reared, with little trouble, small expense and in such short time, they can give over twenty dollars of profit. But it must be hinted a new, that the gains on silk--growing can be obtained without giving up other industries, without buying fodder, without renting any expensive buildings--as stables etc. and at home.*

Silk, mostly used by ladies, clergymen and secular dignitaries, is raised, *(for pastime*, in the Old World) practically by the same consumers and other refined and intelligent persons. Then although it is true that peasants grow silk there, yet they do it directed by learned leaders who take care of the Silk--Caterpillar's eggs in winter and spring and, then, hatch them with artificial healthful contrivances. So it is a matter of fact (when such fine persons attend to this industry) that no hard work is needed to secure a silk-crop and that it affords "good returns combined with knowledge of Natural History as well as amusement.

Those who grow silk in the Old World are provided with *family help*, mulberry--trees and room: but those who will grow it here should have airy room, OSAGE plants—*nice* mulberry-trees, and family assistance—*hired labor not being profitable for silk growing*.

Thence people who find their home-life weary—for need of any occupation and are losing the profits of exercise, practical study of Entomology and *mighty dollars*, could undertake to rear here those dear little pets which produce the precious material, with which are woven those valuable silk-goods, so indispensable to brides.

In Italy, China, Japan and Persia Silk--Culture is encouraged and protected: it being the industry of the people, at large, and at the same time one of the sources for the revenues of said countries, it is guided and directed by their governments. It is well known,

now-a-day, how the Empress of China, presides, in that vast empire, over this most valuable produce, and how, early in spring, she announces to her subjects to prepare themselves for the approaching season of 'cares'; it is also well known how on the 14 of January each year, in Japan is solemnly performed the *rite* of "washing, examining and cleansing (whilst they fast, pray, and sacrifice to their Gods) the eggs of the Silk—Caterpillar. But, perhaps, it is not yet known that, in Italy 12 years ago (1871) the government opened a Silk—Culture Directory in each province of the State and that by the scientific employees of said Directories (right under the vigilance of the Minister of Agriculture) the great Italian silk-crops are generally managed.

Now if the wealth so eagerly sought for by other people and governments, the "silk wealth" *which enabled France to raise suddenly from the disasters of 1870*, is not entitled to be protected and encouraged here also, then we may just think that we are not living in this time of *progress* in which *382 silk-mils are manufacturing imported raw-silk, but in the time of "40 years ago", when silk was grown here, but had no sale.*

C. BRANCELLI.

St. Louis, February 26, 1882.

PUBLISHED
by the
[illegible]

FIRST PART.

HOW TO REAR
SILK-CATERPILLARS.

INTRODUCTION TO THIS EDITION.

The first American edition (5000) of this Directory was exahusted before its number could be distributed to all the persons who applied for a copy. The foremost merits of such an exceptional demand [for a book on an almost new topic] were not alone its very clear directions in rearing Silk-Caterpillars, (because, although there is no Silk-Culture here, in the real meaning of the term, yet here can be had, at least, a dozen of pamphlets on the subject) but also its ECONOMICAL METHOD, *by means of which* ANYBODY *could begin to grow silk, almost without expenses—i.e. neither needing any capital to start with, nor running any risk of a loss.*

Having given the above explanation it is deemed, now, a matter of the utmost importance, to inform the 'would be silk-growers' about the following important inquiries.

Will it pay?

In truth: to grow silk, it is many times more difficult than to raise grain, corn, cattle, or *poultry*: but it must be remembered that, all the farm produces are as much liable to fail (by drought flood, insects, epizotic etc.) as are the Caterpillars exposed to failure by atmosferic influences, although the former are so in lesser degrees. Losses, of any stock, caused by carelessness and mismanagement are

not mentioned in this paragraph!) Yet, to raise any farm crop it is wanted a large capital and a whole year of time, whilst to grow silk no capital is necessary, and only 40 days.

How much?

Silk-Culture brings a great wealth to various countries practicing it, and such wealth is divided, really, among persons of whom it is made mention in former preface. And so; a family of two grown persons and three children can gain from 40 to 60 dollars (and by having a friend's help in the last 5 days, perhaps, $100) in 40 days —an amount of money which could not be earned by said people in any other way.

Of course, this business is better adapted for rural places, where the leaves can be gathered always fresh—a thing almost impossible in large cities.

As for the silk-producing-plants [the food of Caterpillars] the readers are referred to the following preliminary.

Finally; to those who expect to find in these pages a *panacea* for saving the Silk Caterpillars from their diseases and general havoc we say: "*" In the latter part of this Directory the diagnosis of said disorders is described but; Science has not yet found a sure remedy to cure the affected *captive* Caterpillar—although researches as high as those on cholera and yellow fever have been made by congresses of learned-men, on the maladies of the 'precious' WORM! Nevertheless Science teaches that "prevention is better than cure" and therefore it will be insisted on 'preventive rules", in this book, even to bid when the diseased Caterpillars should be thrown away (in order to prevent loss of time and expenses) rather than to wait for their recovery. With such method 'expectations', only, can be lost.

G. BATTICELLI.

How the Caterpillar eggs can be hatched, and their *larvas*, reared in a country where the growing of mulberry has scarcely began, and the notions about silk-culture are mixed so badly, purposely or otherwise? Then again: The mulberry-cuttings, now planted, how long will they stand the inclemency of this cold climate, or when will the people of this country know how to cultivate, protect, nurse, and strenghten this eastern 'Silk Plant?' On this point the enemies of "American Silk-Culture" held the ground a long while, and if it is not overcome, they may triumph again. Also the speculation in mulberry slips, 10 years ago, fell by itself when this eastern plant decayed here in a short while!

Now, without silk-food, presently, and with no *real* prospect to acquire it, in fut ure, what is left to do in order to 'encourage and introduce' silk-growing almost everywhere in these United States? A new silk-producing-food must be found, and proper management must be exercised.

As in regard to the management it will be set down in this book, as for the new silk-producing-leaves, the problem is solved with the following analysis and its explanations:

CHEMICAL ANALYSIS OF

Mulberry-leaves.	*p. ct.*	Osage-leaves.	*p. ct.*
Azote,	3.36	Azote,	3.92
Oxygen,	.16	Oxygen,	.03
Fiber,	.41	Fiber,	.35
Resin,	.28	Resin,	.34
Sugar,	.23	Sugar,	.21
Water,	.08	Water,	.10
	100		100

Azote favors the health of Silk-Caterpillars: *fiber* is digested and emptied: *saccharine* matter and *water* nourishes them, and *the resin*

this employment should make it a misfortune, rather than an help, to a great majority of 'would be silk-growers' only because those would-be-instructors do not know the business in all its branches and make light of it.

The silk-business that was started for "the people" is presented now as if it should be an industry for the gardener, the scientist and the manufacturer. It is clear that things are topsy-turvy. We have no silk-growth, but we have inducements to reel it—a thing which would destroy in experiments even the little silk raised here, or at the utmost, allow to be produced a few coarse home-made silk-goods. We have an unlimited supply of the 'American silk plant', and the market is glutted with mulberry trees. Our people, who do not know much about silk-growing, and have no means to start in this business, are asked to buy cabinet apparatus and expensive outfits. Is this 'Silk-Culture' or, "charity beginning at home"?

It is to keep down such dealings that cramp and choke this great produce, and to increase the wealth of their countries, that other governments have the lead of it!

In order to grow-silk, the following general rules must be practiced with care:—

1. Rear the Caterpillars economically.
2. Hatch the eggs when the leaves are thus:

3. Send the cocoons to the market, by Express, soon, six days after they have been build by the Caterpillars, but do not attempt

to stifle them. (See 'Conclusion' in end of book.)

4. No more Caterpillars than can be attended should be reared

5. Have reproduced only enough eggs to hatch yourself, and some of your mulberry trees, the following year—not more.

6. Sell the cocoons only to those who buy for 'ready cash' after examining the received goods.

The above general, and *business*, rules —together with following directions, are enough to establish (almost suddenly and forever, in the United States) Silk-Husbandry and its good-luck because, those who have mulberry-trees can use their leaves to feed the Caterpillars, and those who have none of them can very well feed with the innumerable osage [hedge] plants—spread, almost, upon the whole surface of the Union, and proved to be just as useful to grow silk, as mulberry leaves.

The above rules are earnestly recommended, especially because, the following wrong informations have been given, here, in the past

1. It is erroneous to attempt to rear, with 'two persons' Caterpillars issuing from four ounces of seed.

2. It is a great mistake to think that, because there is not any market for raw-silk in America, the would be silk-growers must raise eggs—the 99 p. ct. of which could not be bargained, even for a course pair of garters last year and, therefore, were thrown by unpractical breeders into rivers.

3. It is wrong to suppose (or to give to believe) that there is not any market for raw-silk [cocoons] here, and references will be given on 'Second part'.

4. It is not true, generally, that the cocoons are sold at a dollar a pound; an intimation given (under the policy that the producers would be not attracted with lower prices) omitting to inform the silk-growers that, about, one dollar per lb. is the price obtained for

cocoons "stifled and dried"—an average of three lbs. of 'fresh' cocoons to one of 'dry'.

5. It is not to be recommended [as they do] to stifle and dry the cocoons before sending them to the market because, the 'drying process', being even more exact and difficult than 'reeling', cannot be blindly confided in new hands, and purchasers of cocoons have contrivances adapted for that operation, and know their business better: besides 'drying the cocoons' *defers the cash*.

6. They *teach*, also, that the cocoons must, be reeled [i. e. wound off from the cocoons] by their producers, when now a day, large manufacturies supply prompter, cheaper, and stronger articles —even the once home-made stockings, and whilst the reeling work is a very difficult operation.

"What is the historical standing of silk?"

Silk was grown and donned long before SOLOMON said, "[Proverbs, 31. 22.] because, in the next 'translation' it will be found out that Adam dressed himself with the roughly-carded-like shrouds of the larvas rather than with the celebrated fig leaves.

"SHE MAKETH HERSELF COVERINGS OF TAPESTRY: HER CLOTHING IS SILK AND PURPLE."

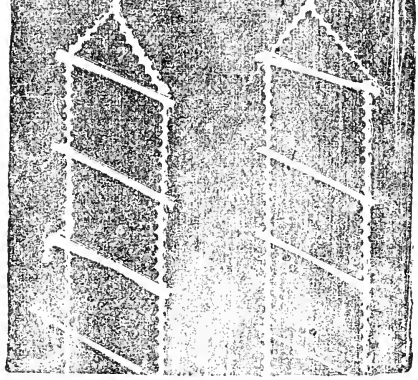
SILK-CULTURE DIRECTORY.

GENERAL INSTRUCTION.

Caterpillars generally live in open air and feed either on herbs or on leaves.

Most of them make silk, but the only marketable silk is produced by the *white* Silk-Caterpillar, so called for the excellence and abundance of its produce—as well as for its domestic habits, or indoor life. —— But although 'man' was able to subjucate also the Caterpillar, yet he did not succeed to change its natural habits; a declaration easily proved because, when these 'domestic invertebral beings' are deprived of plenty of pure air, they surely die. To avoid such a draw-back it has been tried, with good result the hereto described *swinging*

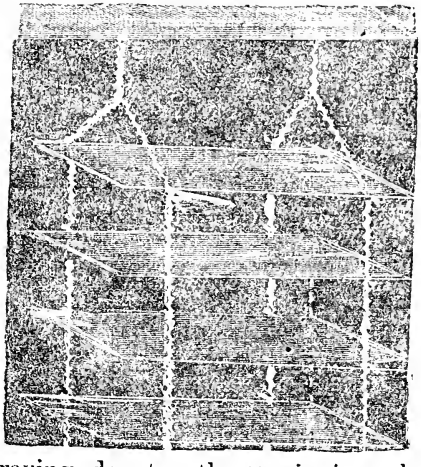
OUTFIT TO REAR SILK—CATERPILLARS.



The above engraving represents two racks hanging from hooks driven in the ceiling. The racks are made with a forked line ['clothes

line will do well'] and cross-rods much like the handle of a broom; these rods are tied to the lines about 15 inches above each other and should be nearly 40 inches in length. The lines, which must be as long as required by the height of the ceiling, are knotted below the forking (as shown in the cut) and hung to place in due time.

The above sketch shows a shelf upon which Silk-Caterpillars are kept—the little creatures never budging from any place where they may be situated. Now to make such shelves, either 'dry' canes, long straight 'dry' branches etc., or lattice laths about two yards in length can be used. With any of the above materials every person can have the ingenuity of building these "airy shelves" tieing one in. apart, with twine, either the reeds or the slats etc.. Shelves like the above, after having been finished, look very much similar to the slats of a spring bed, except that the slats of these shelves are very much narrower.



This last engraving denotes the "swinging shelves" set up for

use. Then, after that the racks [or shelfs holders] have been put in place the lattice-like shelves are laid on the rods and tied to these and the lines.

Another way to make the shelves is by useing *building paper* which, after having been cut to desired length is framed and held between two strips of lumber, which form a kind of a double frame. The framing slips, or slats, need not be heavy as they shall lay on the holders of the racks.

Four, or more tiers hung one above another, as in the drawing form a Caterpillars' *swinger*. With a 'swinger' of more than four tiers a step-stool must be used because, "the bottom shelf should be at not less than from 20 to 24 inches from the floor".

One 'swinger' with five shelves [or hurdles] about 36x72 inches can accommodate nearly 6000 Caterpillars; therefore people having other facilities for 'rearing' should prepare in winter 7 *swingers*.

☞These Swingers should cost nothing, or very little.

(The outfit after the services rendered, the first time, can be easily, stored away to be used in other years.)

* * *

Seven 'swingers' should occupy a room 18x20 and 8 ft. high they should be hung in such a way that attendants may circulate through them freely.

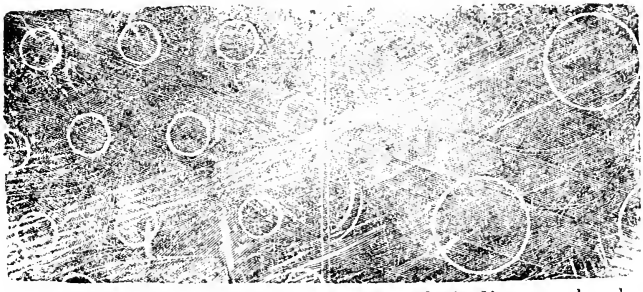
* * *

Next to the "airy shelves" Caterpillar-breeders must have on hand some *new* straw-paper to cover the hurdles: on this paper lay the larvas eating almost always: on this account the paper must be absolutely clean and free from any odor or greasy matters. I is insisted on this subject because a great many insuccesses are caused by rearing them on poisonous *beds*. The paper to be used is the common grocery paper: 75 cents worth of such is enough to cov

10,000 Caterpillars.

At least one third of said quantity of straw-paper must be pierced by holes cut into it at about five eights of an inch from each other. This perforated paper is needed for removing the larvas from their litters. It is very easily prepared by punching in the paper with an 'hollow punch' and a 'wad cutter'. The paper perforated with the 'punch' is used, of course, when the Caterpillars are young, that perforated with the 'cutter' is used when they are full-grown—never being safe to touch the Caterrillars without hurting them. To cut the paper easily it should be ruled first. *If in your family are not used neither 'punch' nor 'cutter' use your pen-knife or a pair of scissors, and make holes in the paper it being not strictly necessaay to be particular in making round holes and other 'general suggestions'.*

SKETCH OF PERFORATED PAPER.



The Caterpillars can be removed from their litters also by means of 'shoots' (as explained in the article on CHANGING) but the use of perforated paper facilitates the operation.

So, also, these most useful creatures can be reared on any other contrivance unlike the described 'swinging shelves' but, these bring the Caterpillars nearer to their *natural life*

* *
*

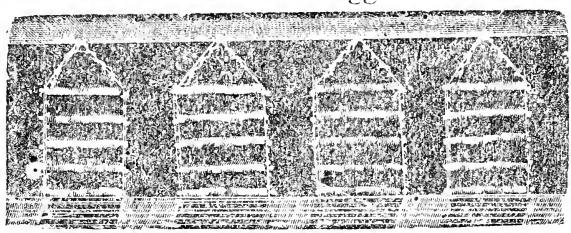
It should be, positively, remembered that all the *few* needs to

rear the Caterpillars must be prepared before that the time of hatching their eggs is at hand, otherwise confusion sets in, and the art shall not run smooth.

* *
*

(Felt paper, i.e. building paper, costs about 3 cts. a yard: so, one shelf could cost, no more than, eight or ten cents. Frames interwoven with thin wire [set at, about, two inches apart] can be also used, but these, as well as any other shelfing, must have, always, the required surface for rearing a stated number of Caterpillars, and must be covered, also, by the straw-paper needed for removing the litters).

Silk-Caterpillars coming out from one ounce of eggs require, at least, *forty six square yards of space*. Therefore:——Any clean and airy hay shed, barn, unoccupied stable, granary, house-room, or any other empty building, or room, about 18x20 and 8 or 10 feet high can be arranged with six *swingers*, holding four 'airy shelves one above another, or with five 'swingers' of five shelves each—it being all the space required to rear about thirty eight thousand Caterpillars, or the issue of one ounce of eggs.



This cut shows one side of a cocoonery-room with swingers ready for use. Four 'swingers', hung from the ceiling and two feet from the floor, are seen by the short side, and five 'passageways': then four 'swingers, occupy 12 ft., the three middle openings 6 feet, the two at the sides 2 ft., and all the room is 20 sq. ft. Now four swingers put as the above would contain a shelfing surface of, only,

40 square yards : therefore to rear, about, 38,000 Caterpillars, another swinger should be added, lengthwise, in the room.

* *
*

It must be known that the *atoms*, or *microscopic* beings,' are supposed to be' the greatest enemies of Caterpillars. (It is a theory which we will confute when we speak of the Caterpillars' diseases, but which we follow for prevention sake-the WORM being so precious.) These 'atoms' live on decayed vegetable matter, and all other matter; therefore it is extremely dangerous to have these Caterpillars near stables, hen-houses, piggeries, dunghills, manure and the like: it is also unwise to keep them too long on their litters, because if the 'animalcules' engender in the latter they, the 'animalcules', will pray, without avail, on the former.

Besides a 'cocoonery' prepared inexpensively, healthy, and handy with already given hints, breeders should have a place wherein leaves, for fodder, should be kept on hand.

* *
*

The Caterpillars must be fed daily (as shall be taught in 'Special Instruction', and can be seen in Table on end of 'First Part') several times: but they want [osage or cultivated mulberry, of course!] leaves absolutely fresh, yet, neither damp nor warmed by the sun, or in any way fermented.

The leaves will become over heated and enter into fermentation when they are picked and, then, 'pounded into the bags' [*for gathering leaves*] as well as when they are kept, 'even two or three hours, in a high heap'. To avoid such troubles, then, and to have leaves in a wholesome state for the Caterpillars, silk-growers must have a place, proprerly, adapted to preserve the leaves. A dry cellar or a barn ,a wood-shed void of odors, well ventilated, but not open to

rain, dampnes, wind or the rays of the sun is suitable.

When a small quantity of leaves is wanted pick them in a basket but when the Caterpillars are grown they use a great many of them and then the leaves must be either carried in a bag, made of loose canvass—or netting, or must be picked, from their shoots, by the children at home, after that they have been trimmed from the hedges and carried there by stronger people.

The last pains are important, only, in the last ten or fifteen days preceding the silk-product, and should be taken only by families rearing the issue from one ounce of Silk-Caterpillars eggs.

In order to have leaves fresh—but not damp, they should be collected in the morning (after the sun is very high up and the fog is disappeared) for the afternoon, and, then, near sunset should be picked those needed in the next morning.

☞*Beware of damp or fermented leaves, beware!*

Breeders having a supply of leaves cannot fear foggy or rainy weather; because they can wait for the leaves to dry on the tree before to gather them anew. But, again, the *reserve leaves* must be kept in a cool light place and on boards, at least, one foot from the floor—otherwise they may be spoiled.

Those who have no leaves in rainy weather should not feed too soon when it clears, because the surplus water not having yet evaporated, would affect the Caterpillars just the same as if the leaves should be wet on the outside.

Although in the last age the Caterpillars must be fed without interruptions, yet *before that time*, especially in rainy weather, they can fast a while *if the provision of leaves* is all used up: but this case should very seldom happen if a good supply of leaves is kept on hand. Indeed, it is not bad to have one 'or two' days *provision* stored in a fresh-dry place, as it has been said before, provided that they

are not more than a foot deep and "not packed down", to prevent which they should be, gently, shaken two or three times a day.

* * *

Our system of Silk-Culture is based on rearing the Caterpillars only, after the "spring rains" are over,, and on trying to accommodate them with their natural choices in order to avoid too much trouble and insure a better success with them; but if the *May showers* last too many days, or if the leaves become wet by any other storm and the good ones have run short, then the damp ones "must be recoverd" before being given to the Caterpillars.

This is done by putting the wet leaves on a "clean floor, or dry boards, moving lifting and changing them, with a pitch-fork [or something alike] from place to place until they are no more damp: then, after a short while, they can be served to the Caterpillars.

This evaporating operation can be performed either in open air or inside of the house with open windows—never mind to do it "near a big flame" as somebody else says, because it wilts them.

Another way to attain the same, consists in shaking the wet leaves in "open" sheets.

* * *

It has been spoken often in this "General Instruction" about the Caterpillars' Outfit and on the necessity of having GOOD FRESH LEAVES, because these are two of the three most impoahant requisites to rear Silk-Caterpillars successfully—the third one being [as in everything else] "cleanliness".

By "cleanliness", in this case, is ment "protection" to the Caterpillars against decayed-life (that is, the *animalcules* engendered with it) and moisture—both of which take hold of the litters when too hold, and cause diseases among the Caterpillars. It is then very

important to take away the 'litters' [that is, 'refuse of leaves etc'.] from the Caterpillars, which is done as in 'Special Instruction'.

When the *larvas* have reached the time to transform themselves into butterflies, they enshroud their bodies in cocoons.

They form their shrouds, or cocoons, by putting together, with their six 'spinning fingers' (or fore-legs-situated below their mouth) in a *zigzag* shape, the resinous matter of the leaves, by them transformed in solid and flexible silk.

Now at that time the Caterpillars need some 'dry' shrub on which they climb and spin their cocoons; therefore silk-gowers should cut, in autumn or early in spring and dry in the sun, either some heath, or some cotton-brush, buck-brush, seed-mustard, rag-weed etc.: any of which, if dry will answer to supply the need. If none of these shruby-plants has been prepared, hay or wood-shavings can be used. How to employ them it is said later on.

* *
*

The standard numeration for Silk-Caterpillars is based on the weight of one ounce of *good* Caterpillars-eggs. Each ounce of them numbers 'in general' about FORTY THOUSAND EGGS. Allowing an unavoidable loss in hatching, and through the rearing term, *good breeders should bring through from thirty six to thirty nine thousand and nine hundred Caterpillars.*

☞One person can attend to Caterpillars issuing from one oz. of eggs "only for about eight days (!)", after that more help is required.——Two persons are able to rear ten thousand Caterpillars: ——three persons can rear twenty thousand;——four, about thirty thousand;——five persons can mind from thirty six to forty thousand of them. For quantity of food, meals, management and othe-

directions it is refered either to the Synoptical Table or to the following articles.

* * *

Besides all the said 'outfit', Caterpillars-breeders should make three or four *trays*, as large as a sheet of straw paper, they being used to remove the litters.

* * *

No more than the above preparations are required to rear, from, thirty six, to, forty thousand Caterpillars—the "isolated swinging apparatus" saving them from the annoyances and ravages of ants cock-roaches, mice, and the like: but to protect them from winged insects (especially if bee-hives and wasp-nests are not very far from the cocoonery-room) it is necessary to have mosquito netting on all the openings.

SPECIAL INSTRUCTION

MANAGEMENT.

I.—TEMPERATURE AND VENTILATION.

The economical and healthfull Silk-Culture System shown in this treatise, relies more on practical cares than on entomological observations; therefore it has not yet been mentioned, herein, any 'speculative' application—supposed to be needed in taking care of Silk Caterpillars. And, indeed, it should have been superfluous to do so because *Silk-Culture* does not at all signify the pursuit of the *real savant* who incases for observation an '*hemelitra*' or an entire *Melolonta*, or a *Papilio machaon* with its peculiar *cephalo-theca* and...excuse me, gentle readers, I was dabbling my bygone knowledge of Zoology with the purely industrious noble art of silk-growing, but..

Of course, it is known that a thermometer kept in a cocoonery suggests the different degrees of heat, which makes the Caterpillars more or less hungry; but it must be known, also, that when the Caterpillars are hungry they should have more food. In such occurrence the thermometer, by itself, does not help much in bringing the larvæ through, but it is necessary to regulate the heat in the hatching room, [see HATCHING] when their eggs are incubated artificially—which needs extra expense and knowledge.

About "ventilation" these golden hints are given: Let the outside air circulate freely in the cocoonery, especially in the nights and

days in which the air is 'sultry'. In these bad 'suffocating days' the *Syringers* will help very much the Cats., for: by moving the former, when feeding is going on, '[and to other cares] the latter will be greatly relieved from the stagnant atmosphere.

It is a wrong idea to think that by closing windows and doors one can shut out the heat: the fact being that the life-cat is shut out, but "the hot stifling air is shut in". Therefore doors, windows, air-holes, sky-lights and any other opening must be kept, in such weather, always wide open—*except* if sun, rain, or strong wind prevail, in which case they must be kept ajar.

Then: in stormy weather, or if the rays of the sun should strike the most useful larvæ, these little almost "motionless and helpless" beings should be protected by half shutting the apertures wherefrom the sun rays, the rain, a 'northerner' or hail-storm can come in: yet said openings should be shut up, only enough to save the Caterpillars [which otherwise could not move about and protect themselves] and when the danger is over they should be wide open again. Fresh air is the first necessity for larvæ (as we will find on dissecting one of them), thence 'though it is valuable to shelter them from atmospherical phenomenon 'disturbances] yet it is always calamitous to keep them locked up.

The celebrated chemists Regnault and Reiset have found that the Silk-Caterpillars in breathing make use of as much oxygen [or life part of the air] as an ox, or a horse, *at own weight*,' that is, taken exceptions of their different natural size: but it must be also understood that in summer an ox, or a horse, would not live in a stable which is not large enough to contain fifteen or twenty times more, the volume of their bodies.

The above paragraph plainly shows that to rear too many Caterpillars in one room, or on one shelf is rather against, than in favor

of their breathing plenty of pure air. Whichever might be the place for Silk-Caterpillars let it be well ventilated, clean, and free from obnoxious odors: admit all possible light but avoid the rays of the sun, and when they are full grown admit all the possible air and shelter them from the wind.

With the above treatment the Caterpillars have pure air and Natural outside temperature. Now this should be always *even*! Therefore, when the temperature is "too high," give to the Caterpillars fresh leaves *oftener* and it will lower, and when it is "too low," supply *less* leaves to attain the reverse of it. [See "Distribution of Meals."]

II.

FOOD.

Silk-Caterpillars, like all other Caterpillars, feed on a particular kind of leaves, which does not agree with the taste of the others.

Until lately Silk-Caterpillars lived only on mulberry leaves, but not all kind of such leaves were whole ome for them, for: if the mulberry-trees were not highly cultivated (by grafting, pruning, manuring with vegetable refuse, etc.) they either decayed or killed the Caterpillars. Now it is useless to speak here about this kind of food almost so rare in America that with it would not be reared Caterpillars enough to allow one silk "bow" to each of our gentle sex! Therefore we will speak of another kind of food, which is just as good if not better, (because more wholesome) than the mulberry leaves.

This food has been already hinted to the lovers of silk-culture, and is the *osage orange leaves*. As they are so widely known here, in the west and south-west, we do not describe them (whose we gave already their chemical value) but we will tell under this article what should be the properties of good fodder for silk-Caterpillars,

and so readers will more pointedly see, that although the osage leaves are hard to be collected, yet they beat the easily gathered mulberry-leaves in other requisites which in the latter must be observed but in the former are not needed.

Good food for Silk-Caterpillars (osage or mulberry) must have the following properties.

First: It must be good, viz: It must be of a "deep green," with closed, shining fiber, and must be produced from healthy and *rank plants*—we have already said that the life of the tree is the life of the Caterpillar.

Second: They must be neither wet nor damp, decayed, yellowish, or with rust-like spots, mildew, overheated, &c., &c.

Third: The Cas. should be fed through all their life, possibly, always with the same kind of leaves—a plain impossibility when the following is pondered.

Then here below we put the different varieties belonging to one specie, (*Bombyx morus*): *Moretti Alba*, *Multicaulus*, *Nigra*, *Russian*, *China*, *Japponica*, *Fillippine*, *etc.*, *e.c.*, and find directly that, as high civilization has been tampering on the natural rights of the animal kingdom, so it has also done on the proclivities of the vegetable one. No wonder if the Silk-Cas. are struck with terrible and destructive epidemics. What it is purported to have been a *white-berry*-producing-mulberry-tree has become now changed by speculators in *rose*, *dark*, *black*, *purple*, *straw* or *lime* berries producing mulberries, by grafting over and over again. And to be short, the properties that were found in the mulberry trees, have been lost or have become poisonous and are against the Silk-Ca'r. We can see how *compact* is the fiber of the osage leaves, but we can only see how *open* is that of the mulberry. How can it be told, then, that the mulberry leaves are more wholesome and also more

productive. Wholesome!... filled with *vibrions, fungosidies, animalcules, microscosms corpuscine*, etc., etc. Productive!... full of holes, gaps, meshes and water reservoirs.

After the above facts to nurserymen we say: Stick to one variety of mulberry and better it with approved cultivation, and then, within fifty years, this vast country, perhaps, will produce much silk from mulberry-trees. But to Caterpillar breeders, we add, rather than to wait fifty years, go ahead now with your American silk-plant, which does not need to be selected before you feed, which never becomes yellow or covered with "rust spots" or "sweets," and is avoided by all other insects and atoms.

To young Caterpillars must be given young leaves not quite deeply green; to grown Caterpillars must be given older leaves and of deeper color.

This management is not hard to accomplish, when it is considered that the Caterpillar's eggs are put to hatch about ten days after the trees have commenced budding. [See Hatching.]

The damper the season (if the eggs are hatched too early or if "the season is late") the more it is necessary that the leaves must be thoroughly *fresh and dry!* Therefore they MUST NOT BE GATHERED BEFORE SUNSHINE OR AFTER SUNSET, especially when dew or fog make them damp. We have already told how to evaporate them when they are wet by showers.

III.

DISTRIBUTION OF MEALS.

As a rule *the Caterpillars should receive *steady light meals* which should be repeated as soon as they are eaten.* But as it is of no use to give a rule, which will not be observed, we say: it is absolutely necessary to give at least six meals a day, at about the following times: The first at sunrise—6 a. m., or thereabout; the

second [illegible] last—9 a. m.; the third before noon—11 a. m.; the fourth [illegible] noon—2 p. m., the fifth before sunset—6 p. m.; the sixth before retiring—10 p. m.

"When the Caterpillars are very young they must have one single layer of leaves for their meal."

Then put on them leaves, one after another, and if they devour them in one-half of an hour, feed again.

Steady Feeding gives a little more trouble, but as it shortens the life of the Caterpillars, it is to be far more recommended. In fact, when the Caterpillars live less time, they are less liable to get diseased. On this very point in the Old World, they rear the Caterpillars by means of *artificial heat*, the contrivances to obtain which, are expensive and difficult. But in this country where the summer heat sets in before the vegetation has attained its full growth, it will not be difficult to obtain enough heat for the Caterpillars when these come forth at about the latter part of April. In this case, if they are fed and well cared after, they will spin their cocoons in about thirty-eight days. Therefore, when the weather is very warm, the Caterpillars should be fed *lighter* and *oftener*, and, when the nights are also very warm, then an extra feed should be given to them late in the evening, 12 p. m.,.

From the above it appears that the Caterpillars use less leaves when it is cool than when it is warm, but they use the same quantity during their existence anyhow, because when *cool* they live longer. The leaves must be distributed always *evenly* at each feed, because otherwise some Caterpillars will be *slow*, and as they grow and fill more space, so in proportion must be increased the quantity of

leaves to be distributed. Exceptions to the above will be found in a special article edited for each age of the Caterpillar.

IV.

ATTENDANTS.

One person can attend to Caterpillars issuing from one ounce of eggs, only until the second *moult*; after that period it is needed another person to gather the leaves, and at the last age (after the fourth *moult*), at last, two other persons are necessary to collect leaves and another to bring them home and help also in changing the litters, preparing the cottages, &c.

☞The original Japanese breed are rather lazy in climbing to their cottages and sometimes would spin their cocoons amongst the litters, thereby depreciating their (the cocoons) value; therefore an extra hand should be required to *push* them to the cottages with the means shown hereafter.

—o—

POSITIVE CARES FOR ALL AGES.

Good food, pure air, much space and perfect cleanliness cannot be useful if Caterpillar breeders do not know the following particulars:

***In a general way, Silk-Caterpillar Breeders *TERM AGE* the time elapsing between each 'moult' of the Caterpillar the rearing of which we will now consider in the following distinct articles:

I.

MOULTING.

Caterpillars moult (that is, *shed, or change, their*, almost invisible, *skin*) four times during their short life.

When they reach each time of moulting they loose their appetite and climb over the leaves, without eating them, where they take an

almost upright position with the fore-part of their body, as will be shown herein with cuts

For a day or more *prior* to each change, the *larva* (‡) seems languid, refuses food, looses its beautiful pearl-white color, and undergoes this important change.

Fastening itself by its legs to the surface on which it stands, it twists and contorts the fore-part of the body until the skin splits along the back, and by progressive contortions and motions it withdraws the whole body through this rent.

The skin, when cast, is often so entire that it may be mistaken for the larva itself.

After each 'moult' the larva appears weak and languid again, while the whole body is extremely soft, and is very wet. A few hours' exposure to the air, however, gives tenseness to the membranes, and it soon begins devouring its food with a greater appetite than ever.

Although the body of the Silk-Caterpillar increases in size from day to day, yet all its segments become, daily, more tense and compact, until the enveloping skin is no longer capable of containing them: then it 'sheds', and directly after the moult the body grows more rapidly. So, people will hardly believe that the body of a Caterpillar that has just moulted is, after the first moult three times larger than before the change;—after the second weighs four times as much as it did before:—after the third weighs twelve times more;—after the fourth, twenty;—when full grown, forty.

(‡) The *larva* is the state of the insect immediately after it is hatched from the egg, in which condition it eats voraciously, sheds its skin several times, and has the power of locomotion, but not that of propagation.

Now, when the Caterpillars are at this stage, in which they remain from 12 to 24 hours, they must not be fed, otherwise (as their metamorphosis is advancing and they are unable to go about) they would be buried under the leaves and, not being in contact with the air, would take a longer time to 'be undressed'.

Besides, it must be known that if the Caterpillars are not *kept evenly*, by means of the rules given below, they cannot MOULT, "almost, all at the same time": thence, it happens that, on the same litter, or shelf, some undergo MOULTING and some are unable to do it: in this case, of course, a number of them does not need food and another does. Then now, a bad expedient should be solved because, if the needy ones are fed, those not so are injuried, being not in contact with the air; and if, to avoid such, these are not fed, the others will suffer for want of food. To avoid this difficulty in rearing Silk-Caterpillars it is needed *eveness* on each shelf.

II.

EVENESS.

To keep the Caterpillars EVENLY must be observed the following rules which, allowing more heat to those hatched later, give them a push to reach those issued from the eggs sooner:—

1. Those hatched the first day must be put on the lower shelf of a *swinger* and kept all by themselves; those hatched the second day must be put on the next shelf; those hatched the third day on the third shelf, etc.

2. The food must be distributed EVENLY to all the Caterpillars, i. e. gently spreading (about) the same amount of leaves to all.

3. If after one or two hours, all the Caterpillars occupying a shelf are not resting to MOULT, those which are yet hungry must be removed from said shelf and put on another—this operation being done as in the following paragraphs on CHANGING and SPACE.

When Caterpillars are treated as above, during their life, they will not be troublesome, because breeders will have always a number of them MOULTING and another number eating—which arrangement permits a good distribution of cares, avoids waste of food and favors the health of the Caterpillars; also lessens the work.

III

CHANGING.

When the Caterpillars must be CHANGED from the old litters (which is explained herein) they must be attracted by fresh appetizing leaves to some place. Therefore, when they are young they must be attracted with the leaves on the *perforated paper* and when old they can be CHANGED by feeding them with young shoots, or small branches with fresh leaves.

It has been already explained how to make the *perforated paper*. Now take a sheet of such paper and lay it on the Caterpillars; or better: cover all the Caterpillars laying on a shelf with sheets of such paper, situated one next to another; then *spread* leaves on the sheets. After you have done so, repeate the same doing with all the other Caterpillars that must be removed: then go to the shelf you first "springled with leaves" and see if the greatest number of the Caterpillars have crowded through the holes on the fresh leaves. If they did not so, wait a while: if they did, take one of the "perforated sheets", by its diagonal corners, and carry it to the nearest empty shelf. Lay it there and go to take the others and put them one next to the other until the shelf is covered with them.

When that is accomplished, look if any Caterpillars are left in the old litters. If you find any of them, remove them to A SHELF KEPT PURPOSELY FOR THE LAZY AND DISEASED ONES; then remove the litters, either rolling up, from end to end, the "straw-paper" whereon they are or sheet by sheet.

☞ If the litters of the young Caterpillars appear well covered with silk-web, it indicates that a good silk producing breed is kept on hand.

After the above, the shelf is ready to contain some Caterpillars again–and so on with all the old litters and shelves.

And that is the operation of CHANGING, or, *cleaning* the litters of the Caterpillars.

If you find difficulty in removing the 'perforated papers' filled with Caterpillars, use half sheet ; or better : pull a sheet on *a sacred tray as large as a sheet of straw paper* (of which tray we spoke in No. 5) and then lay it on a clean shelf, as already written.

When the Caterpillars are full-grown they can be supplied with young shoots without hard thorns–if they are fed on osage. In this case it is not necessary to use the 'perforated paper', because the shoots can be taken on the trays and then replaced on another shelf.

Sometimes the Caterpillars do not MOULT all within one or two hours on the same shelf : then again, after MOULTING, they must have more space than they did before : therefore it is evident that when they are *changed* then more space must be given to them, because after each MOULT they grow larger.

So, if a shelf is crowded with Caterpillars it should be covered twice with 'perforated paper', that is, a number of the Caterpillars must be removed with the first *laying on* and the rest with the second (which makes two shelves from one) : the few *tardy ones* to be put separately.

IV

SPACE.

The Caterpillars must be kept POSITIVELY UNCROWDED. They can be seen on the shelves either crowded as ants around the mouth of an ant-hill, or as a swarm of ants within a few feet of their nests.

If they are scattered, like in the latter case, they have 'space' en-

nough: but when they are almost one above another, like in the former, they must be *divided*. This is done not only when the Caterpillars are 'changed' but also by putting fresh leaves where they appear *swarming* and, after a while, removing said leaves (or shoots climbed by Caterpillars) to a more *open* place of the same shelf—a way to *keep even* all the LARVAS on one given surface.

Should a whole shelf be *over-crowded*, then it must be *made sparse* at once, occupying one or more shelves with its superabundant Caterpillars—in this case to be removed, quicker, with the 'perforated paper', which must not be *pulled*, in this case, but must be *lifted* in order not to hurt those laying under it.

If the silk-web on the litters is too *thick*, it shows that the Caterpillars are too many together (i.e. have not enough 'space') and therefore they must be *thinned*.

SEED, OR EGGS.

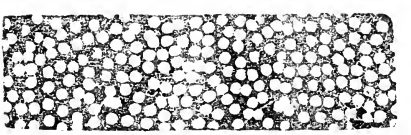
Owing to "monopoly and fraud" Caterpillars' eggs are now becoming more and more unreliable. In fact; formerly it was only important to detect worthless eggs, but at present—fault of the importers of Japanese medicated silk and inferior breed of Caterpillar-eggs one must look out for the "cheap breed" (given away even, free to depreciate the value of the American silk) and try to rear only those Caterpillars whose silk being acknowledged to be the best commands better prices.

In order that people may know what they buy we give the following rules:

The examination of the seed becoming more and more important must be made first on the outside, and then, a little time before hatching, with a powerful microscope.

The principal characteristics of good seed are, externally: a perfect resemblance among the eggs, viz.: they must be all of the same size, have all almost the same color and the same little depression in the middle; they must also stick to the place where they were laid by the butterflies and must be absolutely odorless. Japanese and bivoltine eggs are usually smaller than the Italian annuals, "so being also their coming Caterpillars." If the eggs were laid one next to another, regularly, it is a proof that the butterfly laying them was healthy and lively, but if the eggs are laid in little heaps, it may signify that they might have been sickly.

Fruitful eggs belonging to the yellow-cocoons-best-producing breed are like the white spots in this cut.



They have a violet color when bought in February; appear dark-

gray when bought in March; bought near hatching time they appear light violet, but observing them closely their shell is clearly distinguishable and their inside is nearly black—which is the little Caterpillar body ready to come forth. Besides, every now and then, a little *crackling*, caused by an invisible split in the shell, can be distinctly heard among them. These eggs produce only once a year, no matter what scientific process might be employed to force them to life oftener, and, therefore, are called *annuals*. Forty thousand (*round number!*) of them weigh one ounce.

Fruitful eggs of the white cocoons-producing-breed have the same characteristics and weight of the above. The white cocoons of this breed are very fine, but owing to the fact that they are easily soiled by the Caterpillars, and in handling, their prices are always cut down unmercifully!

Fruitful eggs of a breed producing cocoons white, light yellow and deep yellow, have a *light* olive color: these cocoons are the *pest* of the silk actually raised here in America! Eggs about the same weight.

Fruitful eggs of all *polivoltines*, that is, eggs that will hatch over and over again in one year, have about the same color of the yellow cocoons breed, but about 45,000 of them will weigh one ounce. Cocoons lighter than the annuals.

Fruitful Japanese eggs, light green, straw or white, have color bright violet, etc. About 54,825 of them weigh an ounce! Lighter cocoons still, and the cheapest!!!

Unfruitful eggs are easily detected by everybody when they are dried up; but it must be known that all, either reddish or yellow eggs, are unfruitful *when bought*.

The eggs can also be examined by their *specific weight*, remembering that one gram of *impregnated* eggs contains about 1,250 of

them, whilst one gr m of unfruitful numbers 1,350 or more eggs.

Different breeds can be known by the following means:

Take a few eggs and put them on a small piece of glass, situated on some white paper; then wet them with a drop of common ammonia; if they belong to the annual-cocoons-producing breed, they will suddenly take a deep green color; if they are of the polivoltine green breed, they will take a light brown greenish tint: the white and yellow annual do not change colors.

We have already written how to examine *germinated* and *ungerminated* eggs, breed of eggs, number, etc., and should now tell how to detect diseased eggs. A good microscope could tell it only. Nevertheless we will endeavor to give a few rules: If among the eggs you buy, you detect some of them having small little black spots on the shell, they must be refused because they are infected with the *black scourge*, and will be fatal to your expectations—perhaps just when you think that their hatched Caterpillars are going to spin their cocoons. Then again: if you break a few eggs between two pieces of glass and see that their contents do not appear uniform in round little circlets, and instead of, take oval or conic shapes, they are diseased. A microscopical examination can be taken only with powerful and expensive microscopes, and as these are not at the service of all the people, we don't give here an explanation about it, hoping that what we have said here above might be of good use to all.

When the Caterpillars have been well reared, will produce cocoons, yellow or white (according to breed) weighing 253 per lb. against 332 of Japanese breeds. Then the value of the former is double or treble that of the latter.

We end this article by telling our readers, that the best eggs are

those described as above and that they can be sold on pieces of paper—board, paper or linen, whereon the Caterpillars laid them. Then, if buyers of eggs receive attached or *loose* eggs, they must be more careful in the examination, because sometimes they are fraudulently *prepared*.

HATCHING.

The *early hatching* of Silk-Caterpillars eggs brings around many failures; people fear the warm weather and believe that the Caterpillars fear it also, therefore, they will hatch early, and when it is too warm, they shut up the openings of rooms containing worms and therein they choke the precious creatures. Without heat the little insect does not come forth from the egg, is not lively when young and cannot build its little silken house. Why then hatch the eggs before the full disappearance of cold weather? It must be remembered that the Caterpillars hatched in April will not produce the cocoons before those hatched in May; the former will live from forty to fifty-six days, whilst the latter live from thirty to thirty-six, and both of them will have eaten the same amount of food, with the difference, that those hatched in April, have required nearly two months of attention, and, perhaps, expenses, whilst the latter have required only one month. Do not fear the heat then, no matter what is said against it. We have reared Caterpillars here in the months of *July* and *August*, and have had good produce after the lapse of twenty-four days only. (When too warm do not forget to feed *light* and *often*.)

Hatching must begin when it is known that enough little leaves can be gathered and supplied to the rising little Caterpillars. Then

when on the 10th or 15th of April we see the trees fairly budded, we must bring the seed in the hatching room. (Any room will do only it must be supplied with a stove, thermometer and shelving, whereon to put the eggs and keep the young worms for a few days.) In the first four days in which the seed has been put in the hatching room, the temperature must be, night and day, not below 50 degrees Fr., and not above 55; in the next four days, not below 55 and not above 60; in the next four days from 60 to 65; then add a degree of heat every day until it has reached 77 degrees. This last temperature must be kept in the hatching room in the time the Caterpillars are coming forth as well as through all their first age.

The seed can be put in the hatching room, either stuck on the paper boards where they had been laid or in a little square box as here below. In both cases the eggs should be touched with a solution of common salt in order to destroy any *corpuscle* which might have wintered on the shell, and also in order to weaken the shell and so help the little insect to pierce through it. This *bath* of salt water is applied to the eggs stuck on paper, etc., with a soft wet rag or sponge, but if the eggs are detached or loose, they can be dipped in salt water outright, and after having been kept there for a couple of minutes, they must be spread to dry on blotting paper. When they are dried they must be put (each ounce) in two boxes six by eight inches, (or ten) about one inch deep. Over this box must be fixed a piece of *barlatan* or white mosquito net, (for purposes explained in the article on *first age*) and so prepared they are kept, as the eggs on paper in the hatching room. In the lapse of ten or fifteen days, the eggs put to hatch become a lighter and whiter color, the little Caterpillars are seen in them, a *clicking* is

heard and a few *forerunners* are seen issuing forth. Some people suggest to disregard them, they being so few—perhaps ten or twenty per day; but if these little beings foretell the approaching hatch of their large family (in the same way in which a few cranes foretell the *phalanx* of their near passing army) why cannot they foretell also—being taken care of—the approach of their going to spin their cocoons? It is no trouble at all to take care of such a few, and they will remind you of the sure time in which their kind are going to hatch, to shed their skin, to eat, to be voracious, to spin, etc., therefore be *merciful* with them.

The young insects come forth almost always at the second and third hour after sunrise. One ounce of eggs when progressively hatched, takes two or three days only to produce, but otherwise takes four, five and even eight days—in the latter cases the rearing becoming more difficult as we explain in next article.

☞The rule about the warmth of the weather, given at the head of this article, cannot be applied to the many different climates of the States possessing 'osage plants', because the leaves of osage are "dangerously affected" by showers and the hot rays of the sun.

On this account (to avoyd the, almost sudd lenly, 'thickened sap' of said leaves) it is absolutely important for the prosperity of Silk Culture in those States where the temperature is too inconstant to stard the hatching of the eggs when the leaves are just badding. In this way, it has been experimented that the Caterpillars come up all right.

But, now, must be used artificial heat. This can be easily provided either with the house or with the kitchen heating apparatus; any of which being used must have a degree of moisture, which is procured by constantly keeping on the stove a kettle full of water, containing a little pulverized lime. *WORMS* do always well in

in newly white-washed houses, and are never reared in the kitchen. To keep the Caterpillars warm by means of the direct heat emanating from a cast-iron stove [especially if new] it is to procure the *flacidity* in them.

FAULTS IN HATCHING.

People unacquainted with Silk-Culture, detach the little eggs from the place where they were laid, rubbing, loosing and crushing most of them; then they put them under the mattress, in the sun, or in their breasts at a temperature of 85 to 95 degrees; this is not *hatching*; it is half-cooking the Silk-Caterpillars' eggs—which are kept in a little bag wherein are mixed up bad eggs, shells, little mulberry leaves and little worms together. Then this is the foundation of the silk-rearing disasters, and it is no wonder that many breeders (*who attempt to rear with another person and with such bad hatching process, Caterpillars issuing from four or five ounces of eggs*) scarcely get ten or fifteen pounds of bad cocoons.

CARES DETAILED FOR EACH AGE.

FIRST AGE.

Caterpillars just hatched from the eggs are as large as in the cut.

If they have either a deep chestnut or a dark color, they are healthy; but if they are reddish or black, they have been hatched badly, are sickly and will give trouble; better throw them away. At about noon and six hours after, *gather* the little Caterpillars, putting tender osage or mulberry leaves on them, or on the mos-

quito net—about which has already been spoken of. Let the leaves remain so for about one hour and they will soon be covered with hundreds of Caterpillars. Take, then, each leaf again very carefully and from the *petiole*, and lay them one after another on a sheet of straw paper, which you must have already situated near the hatching eggs: when this paper is full pull it on the *small tray* and situate it on a lower shelf, and there put also all the other sheets of straw paper covered with leaves full of little Caterpillars *gathered* the first time. When you *gather* the Caterpillars the next day, put them on the above shelf and so on. Such treatment is needed to keep them *even*.

A couple of hours after you have *gathered* the young Caterpillars, feed them with well cut up leaves. Do not *mash* the leaves when you cut them up, but after having made a little bunch, cut them as small as a hair, if possible, with a sharp knife. Lay, then, these *shavings*, *evenly* on the Caterpillars and repeat such as soon as they dry up. When you feed allow always *more room* to the Caterpillars. (See paragraphs on SPACE and HATCHING).

The color of the little Caterpillars originate from hairs, with which their body is covered, although their skin is really *whitish*, and their snout black and shining. When they are three days old they become hungrier, their head whitens and their bodies are a dark yellow. On the fourth day they appear *yellowish-blue;* on the fifth, their appetite lessens, and on the end of the sixth day they *rest* for moulting. The first cut on next page shows the Caterpillars in a *moulting* attitude, which is *stillness*, *head swollen*, *fore-part* of *body* elevated.

In all the MOULTING HOURS, care must be taken that the Caterpillars are not struck by a "sudden change of temperature:" therefore, to the windows and all other openings must be given the

proper attention. Neither must they feel sudden shocks; hence care must be taken in moving, "with more consideration in the moulting hours", the *swingers* on which they are laying.

Caterpillars should not be kept more crowded than they are seen in the above engraving.

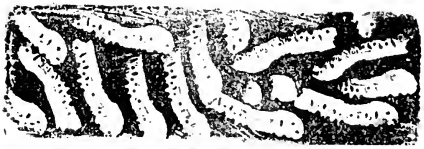
Bivoltine issuing from the eggs are a little smaller than the Caterpillars of first cut. In all this age no more than twelve pounds of leaves are needed. For food wanted daily and in each age, see table published in this Directory.

SECOND AGE.

One or two hours after Caterpillars are *moulted*, they begin to look for food, which must be given to them on the small-sized perforated straw paper (page 18) in order to change them. (See CHANGING).

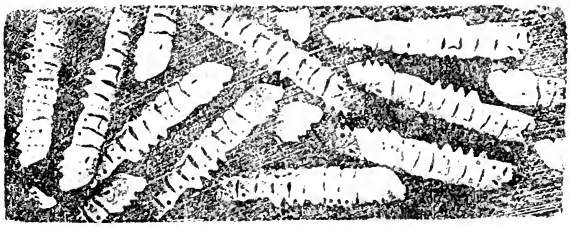
Caterpillars issued from one ounce of eggs will occupy at this age from twelve to eighteen sheets of straw paper, according to the number of them brought safely to this time. They go through this second age in less time than in the former—that is, in five days. When just *moulted* the first time their heads are about three-fold larger than before and are whitish; their body has a dark gray color which continually becomes *clearer* until it takes an ash-colored hue and a little yellowish. At this time two little curved

lines are perceived on their back, as ⁀ ; besides, their body's length increases [if they are healthy] to the size represented in the above engraving, and their weight is almost six times greater than that of their first age. On the third day they must be changed again and situated on from sixteen to twenty-four sheets of paper. When they rest for the *second moult* they are almost transparent and look as in the first cut here below. Food about thirty-eight pounds. (See table).



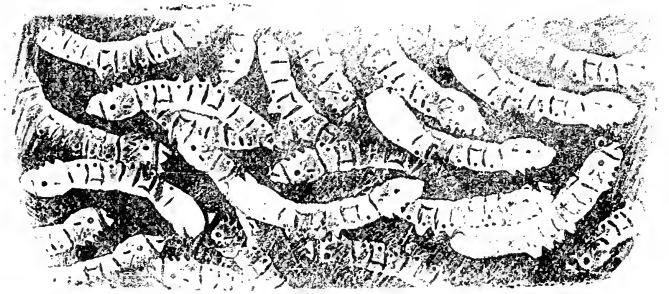
THIRD AGE.

The medium size of Caterpillars are now thus :



This age lasts nearly seven days. The Caterpillars must be *changed*, as has been shown for the previous age. As soon as they begin to look for food they are changed and situated on from twenty-four to thirty-six sheets of straw paper. After the fourth day they are *changed* again and put on from thirty-six to fifty sheets of paper. When just *moulted* the *second time* they seem *pearl-colored*—some of them looking speckled. At this stage of their life they always become more clear and white ; they also increase twice as large and four times as heavy, and when they *rest*

to *moult* the third time, they appear as in the next cut:



ABUSES.

The Caterpillars are kept almost always *too crowded*, and in *changing* them many of them are thrown away with the litters. The leaves are kept too much *piled* up, and when gathered are *pounded* into the bags or baskets. The leaves will ferment or at least *sweat*, which is enough to ruin the best party of Caterpillars.

FOURTH AGE.

(Rules given in the different AGES of Silk-Caterpillars are meant for the number of Caterpillars issuing from one ounce of eggs.)

Caterpillars go through this age in seven or eight days. After having just *moulted* the third time (as well as in all their other moults) they appear for a few hours rather feeble, being still until when their very delicate skin, and particularly their snoots, are grown firm; after having been in contact with the air, then they acquire strength, look for food, lose their light *terra cotta* color, which they had after the *moult* and become more white, daily. Now, it can be very well perceived if they have been eat-

ing, by seeing the eight segments [or rings] of their bodies to appear of a greenish hue. At this time of their life, they grow as large as the above engraving, which has been taken after nature. When Silk growers find their Caterpillars about as large as those herein sketched [unless they are *bivoltines*] they can hope for a good success, as well as when the Caterpillars *moult*, resting about in the same position as the following:

Feed as in the Table. After *moulting* the fourth time, and when they move the *forepart of the body in search of leaves*, they must receive them on *large* perforated paper and be changed. *This time* [if a great many of them have been reared safely] they must occupy about eighty sheets of straw paper or from six to eight shelves, 6x3 feet. On the fourth day they must be changed again, and put on from 80 to 120 sheets—eight to twelve shelves. The Caterpillars are not injuried by *cold weather;* they only need good food, plenty of pure air and cleanliness: that is, they must never lay on *old litters*, and what is worse, on *fermented litters*. To avoid odors, better 'change' in the early morning hours. Do not give too many leaves at once. [See Table.] But if the weather is cold, they do not eat so much; whilst they will eat more than is calculated if it is very warm, and the latter case is better because they become *ripe sooner*.

☞Now it can be said that the Caterpillars 'grow at sight' because two days after they have gone through the size of above engraving, they will increase in body, and appetite 'considerably': and

now is the time to use better cares than ever. Within ten or twelve days, will come either the produce or the disapointment—which will be felt more, of course, by those who expecting to make plenty of money outlayed [“uneconomically and without experience”] a little too much capital to start with.

FIFTH AGE.

At this age the Caterpillars grow in weight six times more than the preceding one, and reach the size of this cut:

In the first two days, after having them *changed* and situated on from twelve to fourteen lattice-like shelves, they must be fed with discretion, but after that time they must be covered with leaves one or two inches deep, six times in twenty-four hours, and if they finish them in less than half of an hour, they must receive more: in short, they *must* eat continuously; if otherwise, they will spin bad cocoons. If the season is very warm, the leaves must be given in less quantity and oftener. Total amount of leaves eaten by nearly 39,000 Caterpillars is about 1,300 pounds. At least every other day the Caterpillars must be changed in this age. If many Caterpillars have not been lost in previous ages, and if the weather is very damp, it is better to situate them in more than twenty-four shelves, as shown in the table. To make it easy change the Caterpillars at four different times of the day, a part each time. When they are changed on the seventh day of this age, the sheets of straw paper must not be *lapped* on the shelves (as it

must have been done before), but must be situated there one inch apart from each other in order to arrange the *dry shrubs* [page 23] among them.

Should the 'litters' appear very damp, and if it be impossible to change, it is useful to sprinkle them with *crumbled* straw.

Woe to the Caterpillar breeders, now, if they shut up windows, doors or any air-hole; if they do, they jeopardize their incoming silk crop. We spoke of this already. If it is too hot, *swing* the outfit a while. If the sun's rays strike the Caterpillars, overshadow them with paper, linen, etc., and if it is damp, *wait*, but do not shut the openings of the cocoonery; remember this, and in a few days you will be rewarded for the pains taken in the short forty days (or less) of cares.

***The above paragraph is limited only when a wind-storm is raging, in which case small apertures will produce a little draft, which can supply all the needed air.

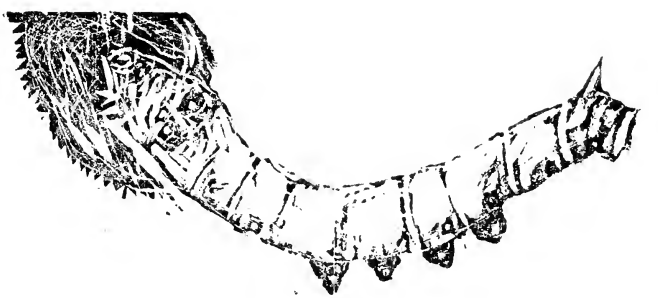
To avoid odors carry the litters a little off, let them dry in the sun, and they will also be a good winter fodder for your live stock.

Caterpillars after their *fourth moult*, which can last even two days or more, (if the *temperature is low* and if they are in good health) when undressed of their former skin, have a *terra cotta* color; next to this they show from their tail up, a transparent yellow rosy tinge, which advances onward toward the middle of the body, until it becomes all of the same appearence—very much like a piece of *amber* examined through the light.

If the Caterpillars are of the white-cocoon-producing-breed they do not appear to be of a yellow rosy hue, but they are *pellucid*, nevertheless.

When the Caterpillars appear so they are near to become *ripe* for *spinning* their *silk-shrouds* (cocoons) and when after a few hours

hey become so, they climb over the leaves, without eating them, and begin to ramble,—even wandering from the shelves if the silk-grower has not provided for them the *dry shrubs*, about which is spoken on page 23. How to arrange, the said shrubs will be written in this work, in apposite article, hereafter. When the Caterpillars have found a place where to spin their silken cells, they promptly climb on them, taking this *posture:*



Remarks:—Now in the above sketch is seen a Caterpillar which, although safely arrived to the silk-producing stage of its life, yet cannot be of any profit to the breeder because it was not provided with the required 'shrubery'. The most useful insect, in this case, is wasting away its silky substance on a piece of mulberry-leaf, vainly trying to fasten the first webs in order to envelop itself in a cocoon.

Here, now it seems useful to point out that neither "little cornucopias (made of old news papers) nor the *PUT THE WORMS TO SPIN IN THE FOLDS OF A DRESS* [as published in a weekly-paper] have any thing to do with the rearing of even a few thousand of larvæ; the 'folds and the cones' might be used by students and curiosity-

seekers, and not by silk-growers. Wooden frames with cells one inch square and one deep are also used, but they are expensive and...and shruby-plants, answering the same purpose, are so plentiful in America, and so cheap!

ERRORS IN THIS AGE.

Not giving enough leaves to the Catepillars, or giving to them tender leaves are mistakes that will put in jeopardy the presumably approaching produce. Want of air and 'changing' are also errors to be avoided. Inattension of mice, poultry, winged insects, cats, is also faulty—if ants invade the 'Swingers', they can be stopped by putting some 'raw-cotton' around and at the top of the lines of the Swingers. When the *shrubs* are situated too crowdy it is also against the larvæ, which in this case cannot be supplied with air and will be suffocated in a short time.

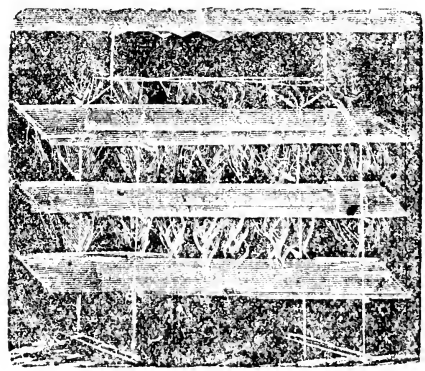
SHRUBBING.

Long before the Caterpillars have reached this stage of their life Silk-growers must have prepared the dry brush-wood, turnip-stalks, heath or hay, etc., etc.

Now four or five days before the Caterpillars are *ripe*, any of the above brush must commence to be arranged on the shelves. This is done as follows: After the fine stems of some of the shrubbery have been cleared of all leaves, seeds, tops, etc., they are placed on the spaces now left between each straw paper, and so the first ripe Caterpillars, which would like to wander from the paper in search of a nook for spinning, find a ready suitable place and there they build their silken house—fastening on some of the little twigs and stems, a web-like-net which they make gradually smaller, long-shaped, round and thicker, until when they have enveloped themselves in

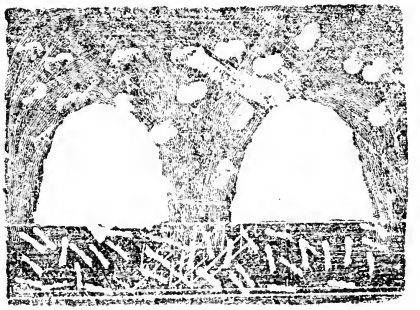
their silken shrouds, usually called cocoons. On the above fine stems of brush-wood others are added *with care* and when the number of ripe Caterpillars increases, small branches are added with

the inferior part on the shelf and the superior one, opened like a fan, laying on the shelf above as in this cut:



If neither the brashwood nor heath, etc., is on hand, shrubby-plants of any kind will suit, provided that they are well dry branchy without leaves, thorns or little twigs, apt to mix up with the outside web (floss silk), and particularly not very crowdy or thick in order that the air may circulate freely also for Caterpillars *ripening* later. This brush must be high enough to fit between two shelves and form an arch under the upper one. If *hay* is used it must be tied up very loose with twine and made to suit the same purpose. When almost all the Caterpillars have climbed on the shrubs, some well seasoned leaves (not dry because they will crumble) of oak tree must be added among those which ramble around without going to work. The shrubs, by reason of their

being progressively added for the use of the *ripe* Caterpillars, little by little take the shape of small cottages as in this cut:



Care must be taken that the side brush do not come outside of the breadth and length of the shelves, otherwise some Caterpillars fall to the ground.

SIXTH AGE.

This period comprehends the time in which the precious *larvæ* ceasing to take nourishment produces the silk (hope and aim of the Silk-Caterpillar breeders) spinning it in cocoons, in which enshrouded, it transforms itself into a *chrysalis*, until the time in which it metamorphosizes itself again into a perfect insect—that is, into a butterfly.

When the Caterpillars begin to become ripe, that is, become nearer to their most delicate transformation they must continually bathe in pure air, but now as well as when they *moult*, they must not feel sudden changes of temperature. Neither cold nor warm weather, hurts well fed, not overcrowded, often changed and well-aired Caterpillars; they must be protected only from sudden

changes of temperature. When too warm do not admit too many people in the cocoonery, and in rainy weather do not admit damp objects, but whilst a sudden cold weather or a bad wind disturb and arrest the respiration of the Caterpillars, the want of air, if doors and windows are kept closed, will choke a large swarm of Caterpillars in a single night.

At this age a too long abstinence may also be against the Caterpillars, therefore if leaves should be wet, they must be dried artificially (we said how in the first part) but the Caterpillars must not be in need of them a single hour.

We insist on the above advices because this is the epoch of the disappointment for those who have reared the Caterpillars without the due attention.

Now at this time the Caterpillars at work must not be disturbed: therefore to *change* those Caterpillars which were not yet ripe, it is necessary to feed them with shoots, and when they have climbed on them they can be removed to another shelf; the litters then are gently swept on the dust pan and carried out. If some ripe Caterpillars do not go to the shrubs they can be moved with care a little towards and near them: when only a few wanderers are left among the cottages, it is better to remove them to another shelf with ready made shrubbery.

As a rule, Caterpillars climbing *freely* produce the best cocoons: when such ones, after climbing empty themselves of a few drops of clear water, they foretell an excellent silk produce. For neatness' sake, sprinkle now a light layer of crumpled straw upon the straw litters.

Two and even three days after the first Caterpillars *climbed* (if they are very healthy and the temperature is at from 80 to 85 de-

grees) almost all of them will have climbed on the shrubs, those excepted which must be put by themselves, as explained above.

Gathering the Silk Crop.

Three days after the *fere unripe* Caterpillars have been removed to a special shelf (or in different words: three days after the greatest number of Caterpillars have enveloped themselves in their silken-shroud) the GATHERING must be accomplished, and if it is done much later, Silk-growers run the risk to spoil the crop, for reasons given hereafter.

This most delightful, easy, and charming occupation lasts, by no means, a short time—when about 38,000 cocoons must be collected. Then, in order to do soon, as is required, it is a treat and a commodity to invite some family friends who willingly will help in this last duty.

The utmost care must be taken in order not to squeeze or mash the cocoons. Thence;—

The shrubs, laden with the ailaring precious silken shrouds, placed upon the bottom shelf of a 'Swinger' must be taken down first, and be situated on a clean place; then all the others progressively. After this has been done, the cocoons must be gathered from each shrub and spread, about three inches deep in a dry place—*say* on one or two well cleaned shelves covered with new paper.

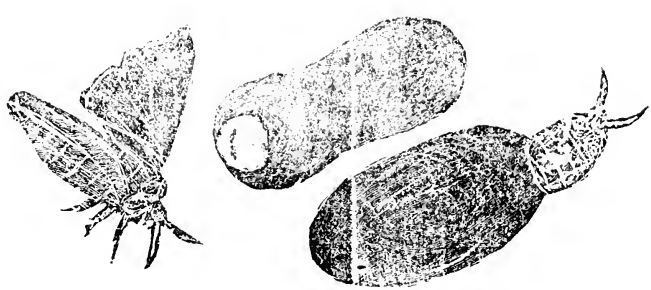
Now, whilst the cocoons are collected, they must be, strictly, assorted "taking away the soiled, the shapeless, all the double-cocoons, (i. e. those few very large and very hard, containing two

larvæ) and all the imperfect ones, which are those not being like the largest number. The size, if the cocoon is not otherwise worthless and if the Caterpillars were well fed, does not depreciate very much the crop. On this account Silk-growers, for their own interest should not mix stained cocoons with the fine ones, if they do the whole lot will be depreciated.

PRESERVING THE COCOONS.

At this stage all the cares of the Silk-grower should be over and only the disposal of the crop should be looked after. Yet, to make this book complete, we give here the next operation performed on the new, or fresh, cocoons.

As these cocoons are the shelter of the larvæ, wherein they become a perfect insect [that is, a butterfly] so, when the larvæ have changed their forms, for the last time, the latter pierce the former and come to the light again, thus:



Now the larvæ become butterflies within 10 or 20 days after they have enclosed themselves into the silk, the higher the temperature

the sooner they transform; and after they are out of the cocoons they reproduce (see REPRODUCTION), but their shrouds after having been pierced cannot be reeled—i. e. wound off for making first class *silk-goods*. Then, in order to make the cocoons good for this operation, the *coming out* of the butterflies must be prevented.

This is done, effectually and *without* spoiling the produce, first by choking the shrouded insects with steam, and then by gradually drying their remains in the cocoons.

To stifle, or choke, it is needed an apparatus wherein the cocoons are spread in different layers two or three inches high: then steam is turned into this air-tight apparatus, for about fifteen minutes, after that, hot-air is substituted in the room, and in doing so the enclosed insects become lifeless and dry, and the silky-shrouds can be kept intact a very long time.

Now the stifling and drying-room is attached always to those establishments which buy the raw-silk—i. e. *fresh* cocoons: therefore it is not to be recommended to the Silk-growers to attempt the stifling of the larvæ—particularly because in doing it;—

First; steamed cocoons, if not gently and progressively dryed up, will mould, and becoming spotted will greatly depreciate: and second, they cannot be sold as soon as gathered, because if their builders are choked they must, also, be dryed to accertain the weight of the silk, and to prevent the moulding of the silk.

At any rate; if in the past it has been recommended to the Silk-growers to "*stifle the cocoons*" (!) it has been because the buyers

did not have accomodations for doing it, or did not know how to do so, or did not want the risk. But when this produce takes such a short time to be raised, it is a pity to jeopardize it with operations which do not belong strictly to the grower: besides it is too bad that the industrious persons who work in early Spring cannot make any money (if any!) until late in Autumn—whilst the stock is on hand and must be kept safely watched and stored!

About the 'reeling' of the cocoons, by the Silk-growers, it has been written enough on the fourteenth page.

Finally; those who raise silk to get a silk-dress, should consider that it is easier surer and quicker to buy one with the money earned in a short time, with the raised raw-silk, than by trying to make one, or to make cheap handkerchiefs, with it.

We found the new food for the Silk-Caterpillar, and we give the suggestions which make Silk-Culture a *real possibility* here.

Selling, and Shipping.

The best way, nay the only way, to sell the cocoons is to send them to the *reeling-mill.*

The *fresh* cocoons, in order that they may not be crushed and spoiled, should be laid in tight boxes having partitions each six inches.

They must be sent by Express, only.

It is better to send to the silk-reeling-mill only the perfect cocoons—the imperfect ones being very few and commanding a very low price. They might be good for fancy home consumption but if they are sent to the market with the good ones they must be laid in one of the partitions by themselves.

The waste cocoons, of a successful rearing, will, scarcely, average two lbs. in one hundred pounds.

Never fill and ship two boxes when you can make one; if not,

Express charges will be double! And if you can join your silk-crop with the Silk-growers of your neighborood, do it and ship in one box with two or more divisions.

*Deal always with a 'truthful and practical Silk-growing-firm' which at the proper time will answer free of charge, for the advancement of Silk-Culture, for the destruction of foreign monopoly, for the welfare of industrious willing youth and old age, will answer all questions pertaining to Silk-Husbandry, with gladness:

But, be sure to avoid the silk-brokers, (real or otherwise), because they buy only dry cocoons and on commission: which really means that they do not buy from you, but that they will sell for you [when they please, or when they can] and pay themselves first the "fearful brokers-fees".

This last part is not about Silk-Culture, indeed, but it is of such importance for the success of it that we conclude with the poet:

"A WORD TO THE WISE IS SUFFICIENT!".

SEVENTH AGE.

Only that Silk-Grower who has had a good success in the *rearing* [say 100 lbs. of cocoons from 1 oz. of seed] should provide the eggs for the following year: for those who failed it would be better to buy seed again rather than to raise it from the sickly survived larvæ and butterflies.

For such purpose must be chosen cocoons of medium size (sk't'd on page 58) as firm in the middle as at both ends, closely woven by the Caterpillars and with very thin silken-threads, comparatively heavy and perfectly finished.

The cocoons must be examined one by one, and must be gently shaken in order to hear the light thud caused by the *pupa* [called also *chrysalis* or *aurelia*] striking the walls of the cocoons, when shaken; but the shrouds that do not give any sound, after being shook, must be disparaged, because their chrysalis is worthless.

Double cocons, (See page 57.) those the least soiled, the 'shapeless and those 'too tight' in the middle must be also disregarded.

It is well to raise double the amount of seed wanted the next year because if the first incubation fails, by any unforeseen circumstance, it can be repeated by using the rest of the seed which has not been put all at once in the hatching room: besides it is always well to initiate some new persons into Silk-Culture, and when a few eggs are on hand they will turn useful for any mentioned purposes.

But it is the *silk* that is wanted and... well the grower will follow suggestions given on page 13, and be repaid for his cares; otherwise his success will come to naught!

As a rule, from one lb. of selected cocoons (nearly 300) can be

obtained one ounce of perfect seed—perhaps one fourth more than the above amount can be obtained, but it is better to be strictly rigorous in the selection of the parent, as here below, than to be careless, or 'stingy', and so prepare unpromising seed for the next rearing. The heaviest shroud will produce a female butterfly, the lightest a male one.

The chosen cocoons, first, must be thoroughly plucked of the outside web, or loose silk, and then must be laid one after another on the new paper of a well cleaned 'airy-sheif' at a temperature of 70 to 80—the higher the temperature the sooner the chrysalis becomes a butterfly, but a medium temperature suits ever better, to larvæ, chrysahs, and butterflies.

Meantime the chrysalis (which is the form taken by the larva before becoming a winged insect) forms itself inside of its shroud. It shrinks from the previous insect into an oblong and oval form, and its epidermis takes a golden hue in the first day of its metamorphosis; then becomes darker and takes the outlines of a butterfly.

Within eight days, if it is very warm, and fifteen days, if the temperature is medium, the outlines become perfect parts and the chrysalis softening one end of its shroud emerges from it.

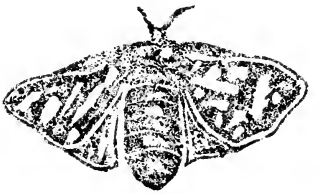
The *Bombix* IMAGO, although is endowed with perfect wings, does not glide in the air—perhaps, because its functions are limited only to the continuation of the kind, and not to the self sustenance: butterflies, do not eat, therefore they do not wander!

At sunrise only, or thereabout, the butterflies come forth.

At first, they have damp and imperfect wings, but in a few minutes the wings take their normal appearance which is:—

Healthy female butterflies are larger than the males, rather heavy for their size, on which account they are almost stationary: their wings are of a pearl-white candor slightly shaded and are always

kept horizontally stretched, like in the following life-size figure:



the wings and the other parts of ths body are evenly covered with a very light down.

Unhealthy females have either ashy or a chestnut color, some times being dotted with a few almost unperceivable black spots on the white; others have an exceptionally enlarged belly, and others are crippled: more about these anoon.

Healthy males, besides of being distinguished by their smaller size and same white color, are lively and with open and shaking wings ["called onward by desire"] whirl around their more steady companions. The wings of the male butterfly, when at rest, are diagonally lifted up from his body. The males are also particularly distinguished by having wider and longer *feelers*.

See page 58 for drawing of male butterfly.

Unhealthy males present the same characteristics of the unhealthy females, 'though more of the former might be almost wingless.

Having described so far, it is now a short work to direct how to make the "choice of the fittest" for the Reproduction. Thence:

A little after Sunrise the reproduction-room is visited and the butterflies already united are gently collected, couple by couple,

and put, not too closely, on a paper laid on a *tray* (page 24) and carried in a room kept perfectly dark but conveniently aired. After that the coupled butterflies have been removed, all the single ones are taken and put together, outside of the cocoons on the shelf; then when new couples are seen among them they, the couples, are brought also in the dark room.

Now, all the couples having been carried away, it happens that either some males or a few females have been left single, for want of a mate, in the reproduction room. Then if the former are mateless they must be preserved, because the next day there might be a majority of females, and if the latter are mateless they also must be kept, and can be mated, after a couple of hours, with a male which has already been in the dark room. But to preserve the male for the morrow precautions should be taken, otherwise he will fatigue himself with his unceasing shaking of wings and roaming about. Therefore the supernumerary males should be kept in small boxes, one by one, where they will be still until the next day, when comes their turn.

Before proceeding: now all the butterflies, emerged from the cocoons on the first day, must be necessarily handled to pass through the above described attentions, and in doing so the opportunity to make the choice is afforded. Therefore, now, give away to the poultry all reddish, yellowish, ashy-colored butterflies; away all the black and black-spotted ones; away all the dropsical ones, that is, those with a swollen belly; away those with one wing and the wingless; away to the fowls all those without 'feelers' or with one feeler, those with less than 6 legs and if among three hundred butterflies are found more than thirty diseased and imperfect ones it is better to do away with all of them and buy new seed rather than compromise the prospects of your future rearing, with eggs the parents of

which were imperfect, even only, ten per cent.*

For easiness and economy sake, it has been directed herein that the selected cocoons should de spread on an 'airy-shelf'; but this given hint is particularly good for those who raise a large quantity of 'industrial seed', for sale or for distribution. But, Silk-Growers who provide for themselves only one or two ounces of eggs, can use a small table, or someting like—especially when they prepare the inclined surface for the reception of the laying batterflies, as below.

This is accomplished by stretching one or two pieces of undressed muslin (which, for the *bath*, [p. 41] is better than paper) on one or two small trays, like those of page 24, and hung like a frame from the wall—but uplifted with a little prop under the lower part and not slanting, like frames, from the top. These frames will answer very well to contain each from 90 to 100 laying butterflies which will deposit about 45 thousand eggs.

Some butterflies will remain united, even, longer than a day, and yet the eggs have been found, as fruitful as when their parents were coupled, only, one half of an hour... *Let them alone anyhow!*

As soon as the females quit the males they must be watched until when they have delivered themselves, again, of some reddish liquid, then they must be taken, anew, gently by the wings, and placed on the prepared muslin.

The butterflies will eject yet some of their superflous humors while they are laying the eggs; as this moisture would endanger the healthiness of the seed, it must be prevented. This is accomplished by inclining the trays—holding the linen, as much as possible and by situating the butterflies from the top, first, and not too closely to each other.

If the choice of the cocoons was made from a party that did not suffer, 'by disease', the least loss of Caterpillars, the laying batter-

flies can be allowed to lay all their eggs, which will be just as good as those laid earlier; but when 'a few' Caterpillars died before building their shrouds, then the butterflies must be allowed to lay for about 28 hours only—the eggs laid after that time containing rather unhealthy life, as it has been found by diligent observations.

After the butterflies have done their duties they are abandoned.

"Industrial seed" is procured as above: "cellular seed" is prepared by rearing each larva isolated in a little cell and then by examining their eggs with powerfull microscopes etc. As only few trust and can follow this method, we do not describe it at lenght.

PRESERVATION OF SEED

The preservation of the Silk-Caterpillar eggs, or seed, is rather difficult and is as follows. First, they must be protected from mice and insects, which is done by suspending the muslin whereon they were stuck, from a ceiling, and by visiting them often. Second: they must be kept from hatching before the leaves which they eat have sprung forth.——The eggs of the 'annuals' cannot hatch before having reached the eighth month of their age, because the embryo of the little insect will not be formed before that time—a few hundred of them hatching much sooner, nevertheless. Now as the eggs, in this country are obtained in the latter part of June so it appears that they would be ready to hatch in March, when there would be no leaves. To prevent such a misfortune the eggs must be kept in a dry room with windows at the north. Air should circulate freely in the room, also cold, but evenly; therefore in a 'cold wave' or wind-storm and at night half shut the windows.

The eggs must be examined often, and in Februray all the red yellow and dried ones must be erased from the linen. [See p. 5..]

CONCLUSION.

The directions given to the present in this book are all what is wanted [*in a positive way*] to know, in order to rear Silk-Caterpillars economically and successfully. We did not give *speculative* informations because they are not necessary to 'practical' silk-growers, but are only practiced by 'experimenters'. Therefore we conclude this FIRST PART wite the following encouraging words:

Those Silk-growers who were scared at given positive and exigent teachings may now reflect on the great warning given by Mother Nature, which provides with many eggs certain species of beings (as to say the moth of the Silk-Caterpillars, which lay from 450 to 500 eggs) because their existence is very difficult to be preserved. Thence the probability to protect them from diseases can disappear for every atmospherical adversity or for neglects and mistakes made in their rearing. Nevertheless, it must not be supposed that the Caterpillars are without possibilities of living: in fact, it is almost impossible to destroy their short existence, when they enjoy it freely: and although they perish sometimes when kept captive, yet it can be said that they are rather killed by their breeders than destroyed by nature.

Now the following information might be sufficient to encourage all persons engaged in Silk-Culture:—

1. Caterpillars can live at a low temperature in which also they

remain in a comatose condition, and do not eat even for weeks.

2. They can stand to a high temperature, when they devour much food and become *ripe* in a shorter time.

3. They cannot be drowned before having been kept at least three hours in the water.

4. The rain does not hurt them, and when it rains, they do not eat before the wet is evaporated.

3. Neither gas affects them nor sulphuric fumigations.

Before coming to the end, this Silk-Culture Directory wishes to say that it is better to take young Caterpillars from **experienced leading breeders**, than to buy even perfect eggs because; one single hatching-room fitted out and out, is capable to furnish in spring, even, 1,000 families with young Silk-Caterpillars: but such number of families require 1,000 hatching-rooms, completely outfitted, and 1,000 experienced persons when they will hatch eggs themselves progressively, and after that they have been properly preserved from the time they were laid to when they are put into incubation.

This last suggestion goes to show that the leading-firm, which distributes [*on nominal and easy conditions*] the principal stock to start *well* Silk-Culture, and *buyes the produce for* READY CASH, may incur a loss, (if it does not know the business, or if the season is unfavorable) but not the silk-growers at large.

APPENDIX.

***

The directions regarding shelves made with "building paper", directions given on pages 17 and 19, should not be understood against the foundamendal principles of this system. In fact; the thick paper, being less porous than lumber, should be perforated in order to be healthy, and if it is not so it will do more harm to the Caterpillars than any lumber shelf, because it will be a worse conductor of air.

0

There is enough of proof to hold that the Caterpillars are not destroyed by imaginary ravenous motes and *vibrions* [See II part], nevertheless we cannot be to stringent in asking, for good success, that the utmost cleanliness should be inforced in rearing the Caterpillars.

For such purpose in the Old World, now that the Caterpillars are fearfully ravaged by diseases and untimely deaths, they use in

washing and disinfecting the old rooms the following drugs; soda, chlorate of lime, sulphur, saltpeter, sulpharic acid, sea-salt, oxyd of manganese, lime etc..

Now the lime is a mechanical contrivance used as white-washing of the rearing rooms, done in order to smite the terrible-invisible *vibrions* [and Co.] whilst the other drugs are used to fumigate said rooms before beginning the rearing, also to blast the *monades*, known, 'by supposition', to be hovering all around the room waiting for the coming prey. We make acquainted our readers with such happening, and now we will also write down one of the proofs spoken of in the beginning of this paragraph. Mrs. Paranilla Chroninger, of Holden, Missouri, received, at the proper time, in 1883, nearly 20,000 young Caterpillars. She had arranged the necessary outfit, described in the beginning of this book, in a well ventiated and spacious room—which had been left unoccupied and neglected for a long time. Before all, she white washed the room as a matter of cleanliness, of course, and because in there existed many troublesome spiders although there were no 'invisible ravenous' atoms. Now the person from whom Mrs. C., and others, received Caterpillars, having been tricked by a meddler was unable to have white-washed his cocconery and, except this important precaution, he used whilst he reared, all and even more kinds of mentioned drugs. The result between these parties stands thus: the lady, who received the little larvæ early in Spring and cleaned her rooms with lye and lime, grow over fifty pounds

of eggs, but the other who had no time to whitewash and went on with fumigations and disinfectants, was not able to save with them, not one single Caterpillar—after "the wet season" set in.

Both the above cases speak by themselves and do not need any comment.

* * *

In some States the leaves are too full of water because the Spring-rains there are almost perennial: if so, the leaves must not be given to the Caterpillars as soon as gathered because, although they do not seem wet yet, they are excessively damp: thence the larvæ must be fed always with leaves collected the previous day, and preserved, as already recommended.

* * *

Butterflies live not very long. The male ones, sometimes a little over a week, the females even 40 days, besides two or three for laying—the sooner they die the less hope can be kept in the vitality of their eggs.

* * *

When the Siroc [that is, the South-East wind] blows, the larvæ must be protected with the utmost care because it has been experienced that this particular wind affects the Caterpillars with dropsy and general relapse: to avoid such, it must be closed, for the time being, every aperture at the S. E.; and when there are many openings in the cocoonery it is better to close, or leave a couple of inches open, those wherefrom any strong wind enters and alters the temperature. It is well known, in this case, how

TABLE

Showing the attentions due to Larvæ issued from one oz. of eggs.

AGES.	Days of life.	Moulting days.	D's of each age.	Temperature.	Space in sh'lv's.	Sheets of paper.	Feeds in 24 h's.	Lv's in each A.	Lv's daily.	Leaves-Pickers.	Attendants.	DAILY STATE of the LARVÆ.	CARES.
FIRST AGE.	1		1	70	1	3			1	1	"	Hatched:—dark color.	Collected, as on p. 43.
	2		2	"	"	6			3	"	"	" " p. 42.	" "
	3		3	to	"	8	8		3	"	"	Hungrier and clearer.	Feedings, p. 44.
	4		4		2	12	"		21	"	"	" "	" "
	5		5		"	"	"		1	"	"	Less hungry.	Light feed, p. 33.
	6	I	6	77	"	"	"	11	"	"	"	Rest for moulting p. 44.	No feeding "
SECOND AGE.	7		1	70	2	12			3	"	"	Moulted:—gray color.	Changing from litters.
	8		2	"	"	14			3	"	"	Deeper color.	" "
	9		3	to	3	16			10	"	"	Become clear.	" "
	10		4		"	20	8		16	"	"	Very hungry.	" "
	11		5		"	24			6	"	"	Head enlarged.	Light feed.
	12	II	6	77	"	"		33	2	"	"	Moulting.	No food.

THIRD AGE.	13		1		4	30			4	1	1	Moulted;—white yellow. Changing.
	14		2		"	38			10	"	"	
	15		3		"	44			14	"	"	Clear.
	16		4	80	5	55	8		18	"	"	Changing.
	17		5		"	"			26	"	"	Hungry.
	18		6		8	"			5	2	"	Light feed.
	19	III	7		"	"		80	2	"	"	Rest to moult.
FOURTH AGE.	20		1		8	60			15	2	1	Moulted;—redish color. Changing.
	21		2		"	80			25	"	"	" " p. 47.
	22		3		10	100			30	"	"	Become whiter.
	23		4		"	"			50	"	"	Hungrier and clearer. Changing.
	24		5	80	12	120	8		90	3	"	" " "
	25		6		"	"			30	"	"	Less hungry. Light feed.
	26	IV	7		"	"		240	10	"	"	Rest for moulting p. 44. "
FIFTH AGE.	27		1		14	140	Feeding never stopped.		60	3	1	Moulted;—terra-cotta cr. Changing from liters.
	28		2		"	160			90	"	2	Become white. Begin cottages; p. 53.
	29		3		20	200			110	"	"	Very hungry.
	30		4		"	"			90	"	"	Not so hungry. Changing.
	31		5	80	24	240			150	"	"	Look famished Plenty of food.
	32		6		"				180	"	"	" " "
	33		7		"				200	"	"	" " Changing.
	34		8		"				260	"	"	Take amber-like color. Cottages.
	35		9		"				150	"	"	More transparent. Cleaning; p. 56.
	36	V	10		"			1300	10	"	"	Build their shrouds. Unripe Cas. removed.

NOTE. It is evident, from the above, that one person could attend and gather leaves at the same time for about 39,000 Caterpillars in the first two Ages only.

SECOND PART.

DISORDERS, OR DISEASES, OF SILK-CATERPILLARS.

PROEM.

"Here all suspicion needs must be abandoned,
All cowardice must, need be here extinct."

Longfellow.

It is well known that all organized beings go through certain abnormal periods, during their lives, which are called diseases.

Industrial Larvæ, or Silk Caterpillars, are thence also subject to disorders in the ordained parts of their body; but, owing to the extreme small size (which among domesticated animals is only next to the honey-bee), to the present, they have been kept out of the cares of the medical science, and at the same time being so valuable have fallen in the researches of speculative savants.

These embroiled in deep suppositions have pretended to suppress death giving out that a parassitical—*microscopical (!)* life was the cause of the most destructive ravages—and the interested people, like a drowning person that grasps at a straw, in order to rear

their larvæ, accepted the theory and *paid*....for some years to the speculative school.

Then the *theory* based on microscopic observation gave way to modern physic; therefore now the insects are studied by patology and biology rather than by unfounded parassitelogy.

To be brief and avoid to employ much space for the microscopic controversy, we will give here below illustrations with the hippotetical points shown by the originators of the microscopic finds—reserving to us the space for exhibiting the inflamatory and phlegmatic character of the more fatal distempers.

I

The contents of a fecunded egg, after having been mashed and spread on a piece of limpid glass will appear under a very powerful microscope either like Figure N. 1, or like N. 2

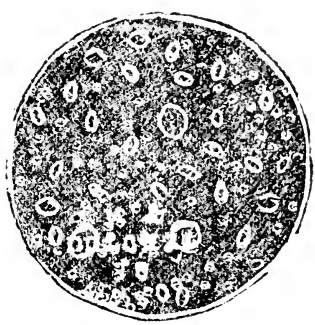


Fig. No. 1.

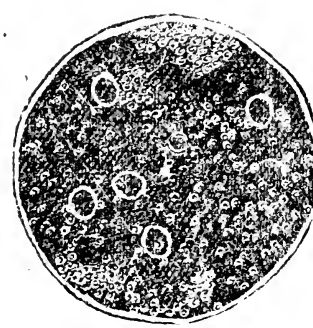


Fig. No. 2.

The teachers after microscopy tell us that Figure 1 contains

corpuscles [i. e. little bodies or physical atoms] which can be only perceived by means of an instrument magnifying not less than 300 fold. When this observation is performed eggs encumbered with corpuscles do not show their protoplastic matter shaped quasi like little dots [as in Figure 2] but among the dotted outlines exhibit a few ovoid, or oblong, shapes as in N. 1.

Those shades, or shapes, scarcely covering the surface of a sq. 16th of an in.—but as bodiless as an umbrage, vibrate [and thence are called *vibriones*] and therefore are presumed to be microcosms, or corpuscles which is all one thing.

But:—Does not vibrate also the substance appearing like little transparent dots?

It does; either alive or dead it does: alive, because it is a protoplasm, dead because it is in metamorphosis. We will enforce our affirmation with the expressions of HERBERT SPENCER;—

"It is not the rustic, nor the artisan, nor the trader, who sees "only something more than a mere matter of course in the hatching "of a chick; but it is the biologist, who, pushing to the uttermost "his analysis of vital phenomena, reaches his greatest perplexity "when a speck of protoplasm under the microscope shows him life "in its simplest form, and makes him feel that however he

"formulates his processes the actual play of forces remains "unimaginable."

And if the dot-like sketch moves, trembles or vibrates, like the ovoid one, why the atomism is applied to the elliptic shapes and not also to the spheric ones? Is it perhaps because the microscope cannot "describe the organism of the *shape* which, only, it has discovered?"

What are these parassitic vibrating atoms, or 'vibriones'? Let us transalate the answer:—

"Corpuscles have a typical ovoidal *form* [form not *body*! Ed.] which sometimes becomes either cylindrical or pyriform. The outline of these 'forms' called corpuscles [i. e. little bodies!] is, in general, a little brown or dark, and at other times is scarcely visible. Their length (we rather say, the length of these only visible *forms* and not of the corpuscles) is about one eight of an in. and the breadth is about one 16th of an in.——How thick they are? Geometry here must be faulty, we have a 'body' with missing sides; but let us go on.——The inside of the corpuscles (real not 'forms') is occupied by an amorphus pellucid slightly yellowish green fluid which is enclosed in a very diminutive bladder; the weight of (real) corpuscles is heavier than the liquid element in which they live. To find out—hear!—what is their nature they were tryed with divers chemicals, but no result was obtained. They, the corpuscles

and not the fearful forms, are insoluble either in hot or in ice water; alcohol, ether, potash do not affect them and neither liquid mineral acids: on the contrary, they are destroyed by condensed mineral acids„.——It is very clear that the above can be applied to 'bodies', even infinitesimal, but not to vain unorganized air bubbles or forms.——

'Lebert' informs that, real corpuscles multiply by fissiparus separations (which we admit, occurs to atoms existing in water), Verson and Haberlandt say that it happens by scission, and M. Pasteur, declares it to be by granulation (admitted for corpuscles living on solid matter; but what is attributed to the *figures seen with a powerful microscope in the inside of a wee egg*, rather belongs to the different genera of atoms existing either in liquid or in solid substances.

So far, then, we have neither a vibrating corpuscle nor a monade [i. e. a moving atom] in the egg, but only a *synoptical appearence artificially procured by means of a compound instrument*, and therefore, any, so called, parassitical havoc befalling on the larvæ must be proved by dissection and not by an artificial examination —and 'guess work' about the eggs.

Because, it is clearly acknowledged that, although the eggs might be affected as in Fig. No. 1, yet 'sometimes' they will produce an healthy brood, whilst the recommended chosen supposed unaffected

eggs, like in Fig. 2, will also 'sometimes' produce a diseased race: "Which is which," thoughtfull readers?

II

Let us dwell now on the dissecting point;—

The appended Fig. represents the gelatinous silk-substance contained in the body of healthy Larvæ [see p. 9.] just before they build their shrouds.

The appended Fig. represents the gelatinous silk-substance contained in the body of diseased Larvæ before they either spin it in a cocoon or die.

Fig. No. 3.

Fig. No. 4.

In the above sketches it is easily perceived that Fig. No. 3 is represented by a *clear* outline the inside of which is supposed

to contain the coagulated resinous part of the leaves, is even and turgid throughout, while the outline of Fig. 4 is broken many times by little transparent bladders very much in shape like the clear little *forms* seen in Fig. 2, and rather thin.

Now we have little bladders indeed: what are they? are they corpuscles? We will answer the question soon.

Meantime we call attention to the following:—

We know that from supposed corpuscle-infected eggs a good successful race can descend, and that from the supposed healthy ones may, also, be expected the reverse of it; but now we must also know that larvæ affected as in Fig. 4 can, sometimes, live and not only produce silk but also become butterflies, and these butterflies may be with the little bubbles seen in No. 4 and may not be so!

Our readers will pardon us, we hope, because the stronghold of atomism, on this subject, runs as explained above. But that is not because the pinnacle of the 'theory' is reached, when we hear expounded again, that the supposed infected butterflies may lay uninfected eggs while the healthy ones can lay them contaminated.

This atomistic principle not giving the sought for relief to the heart-rending misfortunes caused by the destruction of billions of precious insects, is too hard to be followed, and we look at the *effects* of the distempers to study *positive* causes—from which we may try to learn and prevent!...but as yet not [pretend to] *cure*!

FERMENTATION.

All substances apt to putrefy become, whilst they enter into putrefaction, a ferment. The entire realm of organic matter when exposed to a quasi heated air in a moist condition, more or less, rapidily begins to ferment. **What passes in a state of change is called a ferment.**

The fermentation of solid matter is 'in appearance' rather simple: *e. g.* a fruit-cake first undergoes a change of color, and odor, then becomes a fitting object for Mycology and becoming darker putrefies and dries.

The fermentation of liquid substances, instead of, is rather difficult to understand, but once having a suspicion about, it can be, also easily detected: *e, g.* mil'k first acquires a slig'ntly greenish color and has a sour taste [now 'lactic acid' is preparing the 'ferment'] then has a rank smell and little bubbles appear on its surface which at this stage is in full fermentation—the bubbles being effected by expul'sion of oxyd caused by the action of the 'ferment'—and enters into putrefaction becoming foamy and frowzy.

FERMENT does not enter into chemical composition with the fermenting substances or its products. 'Acid fermentation' is being subdivided into 'acetic lactic', 'buttiric acid' and *succinic*.

DECOMPOSITION BY AIR AND WATER:—Complete organic bodies are subject to oxydation and ,u'ltimately, break up into organic

compounds carbonic acid, ammonia and water. If this process of decomposition takes place slowly, it is called *decay*: if rapidly in the presence of more water and with the evolution of an offensive smell, *putrefaction*: under similar circumstances, when the product is a useful compound, *fermentation*.

Most of the above definitions are axioms quoted from standard medical books, in order to pratically connect the following diagnosis of the most destructive diseases of commercial Larvæ.

But it must be also explained—previous to come to a closer argument—what is the link existing between caterpillars and plants.

Every plant (being inhabited by several species of larvæ, that consume its leaves and buds, stems, trunk, roots, sap, and even the old timber) has a capillary system of veins which contains their organic fluid, or *sap*. This sap is a chemical compound of liquid substances and atmospheric gases (resin, sugar, water, azote, and oxigen:) and is subject to two periods of *change*.

Some plants shelter and feed more than one species of insects, but only one specie in each period preceeding the *change*.——It has been already explained that "what passes in a state of 'change' is called *ferment*.——So, *e. g.* the tree-hoppers, crickets, gilded-dandy etc., follow each other by turn in 'sampling' the different tastes acquired in different periods by elm, plum, cherry, and apple-trees

upon which they thrive. Now it would be unnatural to feed a lion on hay and an ox on flesh; thence it would be just as much unnatural to 'keep back' the eggs of the Silk-Caterpillars in order to hatch them when it is more convenient to the breeders—*i. e.* when the leaves are fairly grown—because the insects could not partake of the fresh juice of the plant to which they are naturally destined. Now Larvæ are very voracious because their stomacs are incapable to dissolve their food but merely extract from it a juice: thence they never drink any water obtaining their necessary moisture from the leaves which they eat, no matter how dry they may be. This teaches that, if the Caterpillars eat wet leaves they fill themselves with an adulterated juice, and if they eat leaves after the trees have undergone a climacteric, *change* they devour fermented food, what is still worse, because its juice contains the *ferment*, which enters in their very simple organization and causes them to *decay*.

When the trees are in sap they require a constand temperature to allow the juice to circulate in their capillary channels; should a rain-storm is fo'lowed by hot sun, we see the stems of flowers bend down and often without raising up again——What is that?——It is the action of the rays of the sun on the moist condition of the plants, an action which heats the volatil azote of the leaves and causes the sudden *turning* of the sap, which means collapse and prompt putrefaction. On the tenderer productions of the vegetable kindom

the sudden, or climacteric *turning* (which is not the natural *change*, and often is even fatal to plants) is destructive as above, but stronger plants and trees, although they will survive the effects of the atmospheric change, yet they will have 'turned' sap which, by degrees, affects their limbs and leaves.

The disorders of the plants are more explicitly drawn in administering their juice to Larvæ which we know to be alimented by it.

As early as the budding time we may have hatched one or two deposition of Silk-Caterpillars eggs and feed the issued little Larvæ with the young buds. The insects, being only about 80C, and partaking of the liquid of leaves connected with themselves by degrees of heat, quality of moisture, contact with the air, and age, prosper like all grubs do in their wild natural state, and grow in the ratio of growth allowed to vegetation—and share with it the different graduation of efflorescence which an healthy plant undergoes; but if the efflorescence is turned into deliquescence by bad weather and fermentation, even the small number of Caterpillars, above quoted, will be subject to it because their vitality, mostly derived from the juice of the plant upon which they thrive, will be just as much struck by the 'change' as the plants and leaves have been.

Here, perhaps would be useful to state the density of the fluid found in plants before and after turning; but the connections about the leaves having been lengthy enough for the support of the object

we can now pass to the topic of this Second Part.

Caterpillars breathe by means of two tubes that extend along the sides of the body and give out to each abdominal segment or ring two branches called spiracles, and these, through the *stomata*, or breathing holes situated, (and looking like litttle spots surrounded with a slightly darker shade) at the side of each ring, inhale and exhale air.——That the little brown spots are the real respiratory organs, is proved by putting oil, or any greasy substance near these air-holes, the consequence of which will be immediate death by suffocation.——From these tracheæ also pass out many little tubes that enter all parts of the body, even between the muscles, and so aerate or rather "oxygenate" the blood.

Every Caterpillar has stomach, heart, intestines and two long serpentine organs, like Figure No. 3, which extend to the hind part of the body, and thence back to the neck, where they open at the inferior lip. Those tubes contain, as already said, the substances which the animal uses in spinning, which is yellow or white —according to the food it takes—, and upon this, also, depends the fineness of the silk they make, in the same manner as the quality and color of butter depends upon the food of the cow.

The juice contained in said tubes is nothing more nor less than the juice absorbed from the leaves and as these contain the liquid

essence of resin, so we find it in the silk-repository—when in a proper condition *i. e.* not in a 'ferment'— refined in a consistent kind of paste, or varnish, which would be soon ready to pass through the *spinneret* situated under the lower lip of the insect, to be congealed by contact of air and woven in a cocoon.

So much explained, we will make capital of it to conclude that the existence of commercial larvæ depends;—

I. From the status of the food from which it is derived:

II. From climacteric changes which can strike the insects with ferment directly, and not by the action of the aliment;

III. By unwise or careless 'rearing.'

Here it may be stated, for the support of No. II., that if a Caterpillar is put under water, or alcohol, air bubbles will be seen issuing from innumerable minute holes in all parts of its body; and when the skin is taken off from the insect and held up against the light, the holes may be distinctly recognized, and the whole skin *appears as if it were perforated with an immense number of fine pricks.*—Which shows that larvæ live in an ocean of oxygen which bathes all their external as well as internal organs, and that, when fermentation intervenes, it can invade the little creatures not only by contaminated food, but also by entering through the 'stomata' and the said large number of pores, which pierce the derma, or skin.

From this it must be also established that, the little bubbles seen in Figure four are caused by the expulsion of oxygen from the general system of the insects—oxygen expelled by inflammation, or ferment, which turns the blood and the silk-paste in phlegm, or mucus, *i. e.* state of 'decay'.

It appears that when the 'resinous substance' is coagulated into silk-varnish by the organic principle of the Larvæ, and not by the atmospheric influence, it is abundant, amber-like, odorles and rather firm: but when it is atrofied by the affecting influx, we do not see a real silk-varnish, but only a pale slim, more or less, viscid muck in a decaying state: and we also see that when the weather is unfavorable the viscid humor penetrates all parts of the Caterpillars' body besides corrupting and diminishing the congealed silk situated in the serpentine tubes.

Then again; the more sand essence has become fermented-virus so much the more sudden is the dissolution of the infected insects. The density of the mucus then, (density analyzed from the various bad atmospheric influences) decides whether the larvæ shall die by decay or by putrefaction. [See page 89]

The subject can be argued at great length but, this much is sufficient as an essay, founded on pathological observations, for calling the attention of enlightened breeders. Let us now specify:

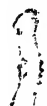
Diseases, in Detail.

To the present we have evolved this argument by connections, now we devolve it by illustrations —

The —incurable— diseases are:

Bursting up, Flux or decay (the latter called also "flaccidity" or "flatness") caused by the unseasonable or turned food, and Putrefaction, or Gangrene, caused by direct climacteric influences:—

BURSTING.—When eggs are not hatched at proper time and young larvæ are fed with leaves about ten days older than themselves they will be struck with sudden acrimony [by reasons given on page 91] even in their first age. The Caterpillars thus affected at this time, without showing any symptom, suddenly BURST at the upper part of their body expelling from it a rather dense dark-yellow humor, and in less than one hour die.



The black spot on this cut shows a little larva affected as above. Feeding with tender-er buds may stop bursting, but on their fourth age, they 'll also, fall prey of the following disease, because the juice of their food-plant will, either change soon, or be too substantial to be assimilated by them.

FLUX, or DECAY.—If the Caterpillars are fed with turned, or fermented leaves, they will not die suddenly but will linger on until their next moult pouring slime, yellow or white, mucus from the skin, besides they become thinner and slenderer, then end their life in black gangrene *i. e.* putrefaction.

This disease strikes the insects, mostly, near and after the fourth moult. In this case they, either do not shed their skin or, die

whilst changing it. But, at the first stage of their decay they do not show by any physical sign the approaching scourge; yet it must be always surmised when the caterpillars grow thin, 'uneven', not showing the shade described for each age and day in this book and positively when they, while young, ramble about, huddle together mostly on the west end of the shelves and throw themselves, or fall on the floor.——Fig. 5, illustrates a larva approaching dissolution after the 4th moult:——Body smaller than its age requires; frouzy yellowish matter from body and bespattered around; little hornet on hind legs 'flabby and black', bottom of props, or legs, also black.

Figure 5.

GANGRENE.—Sometimes the insects prosper and look absolutely well, but the leaves will be spoiled with late dew-and-sun, or the Sout-East wind blows, [page 73] and then they—at any age, and even while they are settling to weave their shrouds—drop unnerved burst and die—all their body becoming, in less than one hour, so much advanced in putrefaction to denote that its contents have been suddenly turned in a fulminating gangrene [the gangrene enters into inflammations like the erysipelas] or apoplexy.

In all the above cases, if the Caterpillars linger and do not recover within three days—in which time they should not receive food and be 'changed', even, twice a day——they can be thrown away, because their desease is induced by 'ferment' which, if it

has taken hold of plants and leaves will not cease to ravage the larvæ to the last one of them, but if it is by atmospheric disturbances it may disappear within such time.

The above are the more destructive distempers of the most useful little beings. Their origin is clear, and therefore let us try to avoid, at least as much as we can, all mistakes leading to strike the Caterpillars with 'ferment' even worse than that caused by climacteric calamitous disorders.

There is no need to declare, here, that we do not recognize the Silk-Caterpillar diseases as contagious, 'though they are epidemical when the juice of their food has been altered—either by ferment or by congelation.

The—avoidable— deseases are:

'Red disease', Atrophy, Vomit, Suffocation, Diarrhœa, Typhus, Dropsy, Jaundice, Asphyxy and 'Curling', these disorders being caused also by the principle of ferment, which in the latter cases has been started by improper management:—

Red disease.—The insects, just issued from the eggs, appear reddish (it has been made mention on p. 43) if the eggs have been hatched with too high artificial heat. When not thrown away they grow affected with the following disease and die.

Atrophy.—It is closely connected with the 'incurable' decay, the only difference between both being that the latter is caused by the Elements whilst the former is produced by overheating of eggs, not food enough, too many leaves at one time, crowding, uneveness, not enough of air, too rank leaves to young larvæ, too tender to the older ones, not 'changing' and all other carelessnesses. Caterpillars

affected with Atrophy [*i. e.* wasting of the body—caused by bad rearing] may recover, sometimes, provided that they are better and neater kept; but they neither can give a good product, nor can be recommended for reproduction. When suffering with this disorder they are not lively, do not moult at given time, eat less, look slender and their color is not pearl-white but rather pale-white and seems shaded with dust.

Vomit.—Leaves warmed up by the sun, or heated in the bags for gathering them, cause vomit. Feeding should be stopped at once, and fumigations of sulphur must be produced in the room untill the vomit is stopped, then the animals are changed and fed with better leaves. Some larvæ may die with this trouble which is plainly seen in the green spots with which the paper is soiled, also the body and, especially the head and mouth of the Caterpillars.

Suffocation.—When the leaves, by being exposed as above, become withered and are eaten by the hungry insects, also when tender buds are given to grown insects or old leaves to little ones, they are strangled in vomiting. The precautions set down against Vomit should be practiced in this case.

Diarrea.—It is embraced in the two last complaints and should be treated accordingly. But when the Caterpillars are fed with leaves not preserved for a day, or so, and the season is a wet one, it is impossible for them to assimilate the thin juice, and therefore they get also sick with this disease: in this case a little 'unadultereted' flour springled on the leaves will do good.

Typhus.—Extreme feebleness causes the Caterpillars to have *purple spots* especially on the head and around the "breathing-

holes. Undoubtedly 'ferment' in the leaves, on the litters and, even, in an unsuitable room for cocoonery, becoming virulent, causes the disease. It is an irreparable one—although the Larvæ affected with it, sometimes, spin, but, only 'passable' cocoons. Typhus is rather an exceptional malady than a general one: when they are struck they will be seen dead and dieing as in the following Figures.

Figure 6.

The above shows a dead Caterpillar laying across a twig on the left; another dead one hanging by its snout on the right: a dieing one at the underpart of right branch and another dead in the cocoon above after having become a Crysalis. The cocoon is badly soiled black, and in the skins of dead insects is found only a black, decayed liquid apt to come forth at any moment.

When the Caterpillars are doomed thus, it is generally said that they die with the 'black scourge'—which really denotes the effects and not the cause of the disease or the disease itself. Sometimes

the body of dead larvæ does not dissolve, as on previous page, but solidifies: then it is said that they died by calcination—in Italian *calcino*, in German, *Pilzsucht*, in French, *Muscardine*; the last two appellations implying that the insects are 'sucked-by-fungi, or killed by 'moss'. This theory prevailed when the theory of the atoms was up: but observations in another line pointed out that the fungi or moss discovered on the destroyed insects were the outcome and not the cause of putrefaction.——Then, to be short: why should fungi and microcosms be the reason of the trouble, when in all the Caterpillar's disorders the inflammation, followed by gangrene, is positively perceived in more or less degrees of destructive power?

Dropsy.—When the leaves contain too much liquid, *i. e.* when too much rain prevails, and also when the insects are weak as in Decay and 'Atrophy' this disease will appear. In other words: when the Caterpillars are badly fed and are not relieved by vomit or diarrhea they will swell, become greenish and shiny, then burst throwing a green-yellow liquid and die. This disease is also much akin with 'Bursting': but while the latter is unforeseen, the former is *caused*! Open air, and remedies given in Vomit, if used in time, will help.

Jaundice. It is very common and generally unknown here: a short anecdote may show this, better. Mr. *** of ** in showing his knowledge about the rearing of the 'Worms' once said to the writer;—"I *alone* reared 80 000 of them last year. I raised them in "a garret without windows, and fed them sometimes once a day! "They, all, grew splendidly and, when they were near spinning, "they were full of silk measuring one inch and three q. around and "nearly four inches in length. They climbed the brush to spin, and

"either split open among the twigs or dropped from them and, pouring yellow matter from *cracks* in the skin, died". What was the color of the Caterpillars Mr. ***? It was a beautiful yellow color....

Larvæ are never struck with Jaundice in the first ages: when so, they are just like those described by Mr. *** *i. e.* like the following

Figure 7.

What is it? Possibly it is the resinous essence altered in a dense viscid substance instead of to coagulate in an elastic one. Keeping the insects not aired enough, feeding them with wet leaves, and not allowing them plenty of space causes it. As soon as discovered, the Caterpillars should be moved in a larger room and be situated on more shelves. They will spin a light produce if they do not die.

Asphyxy.—The Larvæ struck with asphyxy will appear alive although they may have died a couple of hours before. Want of air, and sultry weather will do it. By closing windows in the rearing-room a tryal of Asphyxy can be quickly had. [See bottom of p. 73.]

Curling.—A very few grown Larvæ, in every rearing, instead of climbing on the cottages, their props having become scalded-like, or sore, on the litters, shrink and curl up like in Fig. 8; then

Figure 8.

become worthless Chrysalides without weaving cocoons; but if they are imprisoned in a small box or each in a little cone made with paper they will spin medium shrouds.

——BUTTERFLIES' DISEASES.—Dropsy is the only well designated Disease of the butterflies, because, when ill with it, they plainly show its indications, which are: deep gray color; largely swolled belly; dark wings; almost motionless; often unfruitful etc. But although this diseases shows itself without difficulty, yet it must be admitted that butterflies sometimes are also affected with Typhus, or 'black-scurge': in this case, as they had no power to develop into a complete perfect insect, so their wings are short uneven and crippled, whilst little black spots of fluid appear near the 'stomata', the upper segments of their body and on the wings. These spots were the vital humor, or blood, of the insects; this humor not having the density possessed by healty blood, and finding relapsed the porous system of a weakned butterfly dripps out and, coming in contact with the air, assumes the unhealthy color. This explains why all the abnormal butterflies should be disregarded for reproduction purposes, as it is explained on page 66.

COROLLARY.

The following inference may be fairly drawn from all the information contained in this Treatise:—

1. Silk-Caterpillars, although reared indoors, to protect them from birds etc., yet they should be treated as if they should be living in their Natural State.

2. Considering that they cannot be neglected; that the attentions bestowed upon them are light instructive and pleasing; that hired labor *is high*, and that atmospheric influence may hurt the insects—no large capital should be invested in Silk-Culture, but instead of, a reasonable number of larvæ should be reared by intelligent persons—who have 'time to spare' and accommodations.

3. A fortune cannot be made in growing silk: yet if the members of "a family at leisure" can gain [say] $40, in a little over a month, and at home, and if 1,000,000 families grow silk here a new wealth of $40,00,000, sprung up from nothing, can enrich the honest and willing people of the U. S.

GENERAL TABLES.

One ounce of eggs of Caterpillars producing yellow cocoons, contains about..... 40.000
" " Japanese breeds contain about..... 60.000

The produce from each ounce of eggs can be estimated thus;—

	yellow breeds	Japanese breeds
Very good	lbs. 135	lbs. 120
Good	" 100	" 85
Medium	" 75	" 60
Poor	" 45	" 30

On a produce of Caterpillars or eggs lost or dead are

lbs.	135	"	"	"	from	3.000	to	6.000
"	100	"	"	"	"	5.000	"	8.000
"	75	"	"	"	"	15.000	"	18·000
"	45	"	"	"	"	25.000	"	27.000

	Price per lb.
Average price of *fresh* yellow cocoons	45 cts.
" Japanese "	28 cts.
dry "	$1,10

One lb. of fresh yellow cocoons contains about 255 cocoons
" Japanese " " " 395 "

*Three lbs. of *fresh* cocoons will make one of *dry** (!)

If the weather be very hot (78 d.)	will weigh lbs.
One hundred lbs. of cocoons after a day	99, 4 oz.
One hundred lbs. of cocoons after five days	97
One hundred lbs. of cocoons after ten days	92

Osage hedge fencing a sq. acre can furnish food for 60.000 Larvæ.

One butterfly lays from 393 to 516 eggs.

95 Butterflies lay about 45.555 eggs some of which are imperfect.

One yellow cocoon has a thread about *1.000* feet in length.

Any other information on this subject will be cheerfully given by the author.

The head of a Caterpillar that has just cast its skin is, at least, four times larger than it was before.

When a born larva is in length		3	sixteenth of in.	
After the first moult	"	8	"	"
" second "	"	15	"	"
" third "	"	26	"	"
" fourth "	"	42	"	"
In full growth	"	56	"	

One *ripe* Caterpillar weighs	from	75	to	80	Grains
" chrysalis "	"	45	"	55	"
" female Butterfly "	"	28	"	32	"
" male "	"	15	"	50	"

THE END.

The Mississippi Valley Silk-culture Enterprise.

WHAT IS IT?

The aims of the Firm known as above are the following:—

1. It intends to establish here Silk-reeling-mills, and to do so, it is arousing and organizing the whole country for raising a yearly silk-crop: imports of *reeled-silk* in 1880 were: $12,024,690: imports of manufactured-silk: $33,305,450: from latest official statistics, and, *figures tell facts better than words!*

2. Knowing that a yearly silk-crop can be grown here (as is explained in the "Silk-Culture Directory, and not with extravagant outlays") the Director of the Firm is offering every inducement to lead into Silk-Culture all willing persons, without charging them under any pretence whatever!

3. And it has *READY CASH* to buy the produce raised under its management, and with is supplied starting-stock.

4. Said Firm also enrolls in a co-operative Co. all those who grow silk, as above;

5. The cooperators of the Company being entitled to *dividends* without buying any *stock*, when the business is fully established:

6. The number of cooperators, or members of this Co., to be limited at not over one thousand for the present and to be *unlimited* when the possibilities of the Co. are fully developed:

7. So, if this Co. supplies raw-silk enough within one, two or three years, and this silk is reeled at the Company's mills, all its members will be entitled to *FIFTY* per cent of the *NET* profits earned from the sale of the reeled-silk: the other fifty to go to the advancement of the silk-manufacturing business and to the capital employed to start with.

8. The above rule is also applied if the silk-looms shall be started in due time.

9. The present management of the M. V. S.-C. C. reserves its rights to employ, in its branches, only members who are capable to perform some special duties, for the business.

10. Agreed that the interests of the M. V. S. C. C., which is

only a Cooperative Company, can be only liquidated for payments of its own indebtedness (if it will have any)—its members, being copartners, cannot be made responsible.

11. Yet the members of the Co. can ask an accounting of the business, if any fraud will be advanced into it:

12. So, if the earnings are above the whole expenses—those for the advancement of the Enterprise included, as buildings etc., and no dividends are paid, the 'real estate' of the Co. can be seized and claims asserted thereof.

13. But the business, if not answerable under the above article is inalienable and belongs to its present right owner or owners.*

14. The accounts are given to all co-operators, in a yearly supplementary edition of the Silk-Culture Directory.

COPARTNERS, OR MEMBERS OF THE COMPANY.

1. "All persons that have room, family help, and acreage or cultivated mulberry-trees" (as explained in our guide-book or Directory) and engage themselves in growing silk become members of this Company.

2. The members are only those who subscribe the engagement form", and not each person belonging to her or his family.

3. They are entitled to fully one-half of the earnings of the Company, as stated in previous No. 7—to be divided among all co-partners. It is deemed possible that within ten years more than $100,000 can be yearly divided among twenty thousand members.

4. By 'earnings' it is meant the profits accruing to us as of the business management of the Co.—*after having benefit from its coworkers for yearly sales of cocoons, i. e. the green silk.*

5. But to share in the above, now undeveloped profits, the members of the Co. must be yearly *Silk-growers*, and must not give up in case of some failure or mishap Caterpillars.

6. Besides; they must be known as 'silkers among friends'.

7. The names of all the co-partners, or members, will be published in this Official Organ of Silk-Culture, 'copyrighted' and issued only by the MISSISSIPPI VALLEY SILK CULTURE ENTERPRISE CO., which is the only CO-OPERATIVE silk growing CO. in the United States of America.

8. Read the NOTICE in this paper.

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—B. [illegible] on Caterpillars.—

"So easy and [illegible] the process of growing silk that, it is surprising that [illegible] living in our country villages do not more often engage in it. Nothing could be easier than to raise silk from the [illegible] and might realize a handsome salary. [illegible] ordinary advantage, the enobling nature of the [illegible] be ample compensation for all the [illegible] by a sufficient remuneration for [illegible] recreant hours."

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